PREVALENCE AND RISK FACTORS ASSOCIATED WITH UNDER-5 MORTALITY: A MULTI-COUNTRY COMPARATIVE STUDY IN SOUTH ASIA

Hasan Sohail

Master's Thesis

Faculty of Social Sciences, Health Sciences

University of Tampere

(Global Health)

October 2017

Abstract:

University of Tampere

Faculty of Social Sciences, Health Sciences

SOHAIL HASAN: **PREVALANCE AND RISK FACTORS ASSOCIATED WITH UNDER-5 MORTALITY IN SOUTH ASIAN COUNTRIES-A MULTI-COUNTRY COMPARATIVE STUDY**

Master's Thesis, 75 pages

Supervisor: Subas Neupane, PhD, Docent

Global Health

October 2017

Background: Remarkable achievements have been made in the last decade to reduce the child mortality worldwide. However, South Asia has one of the highest number of child deaths. Out of 10 child deaths worldwide, three occur in South Asia. The under-5 mortality rate is still very high with 51 deaths per 1000 live births. Moreover, the overall and country-specific risk factors associated with under-5 mortality in the region are largely unknown. This thesis aimed to study the difference in under-5 mortality in WHO South Asian countries and then to explore whether the associated risk factors are the same or different across the countries of South Asia.

Methods: This study was based on Demographic and Health Survey (DHS), data collected from five South Asian countries (Bangladesh, India, Maladies, Nepal and Pakistan). Data was obtained from the most recent live under-5 births from mothers within five years prior to the survey (n=570676). Under-5 mortality, death of the children from day of birth to fifth birthday of child was the outcome variable in this study. Association of under-5 mortality with risk factors including socio-demographic variables was studied using Cox Proportional hazard method. The estimates were presented as hazard ratio (HR) and their 95% confidence interval (CI). Survival Curves were used to explain the difference in survival of under-5 children in each country.

Results: Overall prevalence of under-5 mortality in South Asian countries according to pooled data was 10%. Country-specific results showed that Nepal having the highest prevalence (11.1%) of under-5 mortality followed by India (10.3%) and Pakistan (10.2%) in South Asia. In a multivariable model in pooled data, older age of the women (HR 0.70, 95% CI 0.68-0.72), being employed (HR 1.09, 95% CI 1.07-1.12), having husband with higher education (HR 0.74, 95% CI 0.70-0.78) and having higher education (HR 0.36, 95% 0.32-0.40) were significantly associated with under-5 mortality. Among other maternal and child factors, being female child (HR 0.95, 95% CI 0.93-0.97), wanted no children (HR 0.92, 95% CI 0.87-0.97), no contraceptive use (HR 0.95, 95% CI 1.30-1.37), currently pregnant (HR 1.17, 95% CI 1.17-1.23), no smoking (HR 0.85, 95% CI 0.83-0.87), male sex of children was associated with under-5 mortality. Most of the studied risk factors were common across the countries, but some difference in the factors associated with under-5 were country specific.

Conclusion: The prevalence of under-5 mortality is still high in South Asia. Most of the socio-demographic factors are associated with under-5 mortality and are common risk factors for under-5 mortality across WHO South Asian countries. For improving the under-5 survival and achieving the Sustainable Development 2030 target, countries in South Asian region needs to put efforts on maternal and child health. Country specific strategy should be focused on most prevalent risk factors. A multi-faceted approach that includes health and other related measures is needed to improve the child survival

Keywords: Under-5 mortality, WHO South Asian countries, DHS, Sustainable Development Goals, Socio-demographic variables

List of Acronyms:

CDC	:	Centre for Diseases control and prevention (US government)
CIs	:	Confidence Intervals
DHS	:	Demographic and Health Survey
GHO	:	Global Health Observatory
HR	:	Hazard Ratio
IMR	:	Infant Mortality Rate
LMIC	:	Low and Middle Income Countries
MDG	:	Millennium Development Goals
NMR	:	Neonatal Mortality Rate
SDG	:	Sustainable Development Goals
SPSS	:	Statistical Program for Social Science
U5M	:	Under-5 Mortality
UN	:	United Nations
UNICEF	:	United Nations International Children Emergency Fund
UNDP	:	United Nation Development Program
WHO	:	World Health Organization

Table of Contents

List of tables:

List of figures:

1. INTRODUCTION

Under-5 mortality is significant public health issue and an important indicator for assessing the progress of a country. United Nations International Children's Emergency Fund (UNICEF) defines under-5 mortality as "the probability of dying between birth and exactly five years of age". There are inequities regarding under-5 mortality and health policy in developed and developing regions. According to statistics of child mortality in 2015 by World Health Organization (WHO), in European region child mortality rate is 11 deaths per 1000 live births in contrast to 100 deaths per 1000 live births in WHO African region making it seven times higher than Europe (WHO, 2015).

Infant (first year of life) and neonatal (first twenty-eight days of life) deaths share major portion of under-5 mortality. Infant mortality rate (IMR) and neonatal mortality rate (NMR) are important indexes for studying a country's state of health (Chang, 2011). In Asia, lower child deaths in 20th Century caused increase of working age population and lower dependent population. Hence positive demographic changes and higher rates of child survival can promote economy in South-East and South Asia (Bloom, 1998). 4.5 million children die during their first year of life which makes 75% of all under-5 deaths. Risks of infant mortality are highest in Asia and Africa with a rate of more than 55 per 1000 live births. Neonatal (first twenty-eight days of life) mortality accounts for 45% of under-5 mortality (WHO, 2016). Almost 1 million neonates die during the first day of birth or roughly 2 million within the first seven days of life (WHO, 2016). Although morality rate of neonates dropped down by 47% from 36 to 19 deaths per 1000 between the time periods of 1990-2015 (UNICEF, 2016).

South Asia holds a major share in neonatal mortality. A recent multi-country study also highlighted the worst survival of neonates in South Asia compared to neonates born in other WHO regions (Doku and Neupane, 2017). Between 1990-2009, countries having more than 50% of neonatal deaths were: India 27.8% (19.6% of global live births), Pakistan 6.9% (4.0%), Nigeria 7.2% (4.5%), China 6.4% (13.4%), and Democratic Republic of the Congo 4.6% (2.1%) (Oestergaard et al., 2011). These statistics show that most of the neonatal deaths occur in South Asian countries.

Millennium Development Goals (MDGs) were agreed globally in 2000. There were eight goals that all member states of WHO signed. MDG 4 was to reduce the child mortality by two third among under-5 children (Mdgfund, 2017). Under-5 deaths reduced from12.7 million to 5.9 million between 1990 to 2015. Out of 195 countries, 62 were able to meet the MDG4 target including 24 low and middle-income countries. MDG4 target was achieved by only two regions: Latin America and the Caribbean and East Asia and the Pacific. Regardless of the decline in U5 mortality, increased efforts are required to increase the rates of child survival especially in South Asia and Sub-Saharan Africa. (You et al., 2015).

In WHO South Asian region, Bangladesh was able to meet the MDG4. They were successful in achieving the target of 48 per 1000 live births in 2015. Successful programs of immunization, management of diarrheal diseases and vitamin A supplementation were key contributors in achieving goals. (UN, 2016). Similarly, according to the recent mid-term survey of Nepal Family Health Program, MDG 4 was met as under-5 Mortality was reduced by two third (Oneworld, 2016). While Pakistan, India, Bhutan and Sri Lanka from the same region were not able to meet the MDG4 in the same region (UN, 2016).

With the end of MDG era, 2030 agenda for sustainable development was presented. Seventeen Sustainable Development Goals (SDGs) were agreed by global leaders on the basis of millennium development goals (UN, 2015). SDG goal 3 target 3.2 is to reduce the infant and under-5 mortality by 2030. The target is to drop the "neonatal mortality as low as 12 per 1000 live births and under-5 Mortality to as low as 25 per thousand live births" (UN, 2015). According to UNICEF, problem of under-5 mortality requires urgent attention from health sector. If the conditions remain as such, approximately 60 million innocent children will die until 2030 (more than the population of Thailand).

The conditions for under-5 deaths are alarming in the developing countries. Around 29,000 under-5 deaths happen every day, 21 each minute, and mostly from the preventable causes. Around 70% of deaths are because of diarrheal, preterm delivery pneumonia, neonatal infection, and lack of oxygen at birth. Poor sanitation, lack of safe water and malnutrition are indirect risk factors contributing to half of the U5 deaths ("UNICEF", 2016). Poor children are more prone to diseases as compared to their better off peers (Victora et al. 2003). However, very little is known on the risk factors associated with all-

cause mortality specifically in South Asian countries and then to explore whether the associated risk factors are same or different across the countries of South Asia.

2. REVIEW OF LITERATURE

2.1 Child Mortality

Child mortality or under-5 mortality is defined as the "death of children under the age of 5 years" (UNICEF). In the last two decades, significant progress has been done in reducing under-5 mortality. The global rate of under-5 mortality "dropped 53% (from 91 deaths per 1000 live births in 1990 to 43 deaths in 2015)" (UN Interagency group, 2015). In 2013, 6.9 million children died under the age of 5 which is 64% less than the 17.6 million in 1970 (Wang, 2014). Some countries made remarkable progress for example, China reduced under-5 mortality from 28.4% to 1.3% in 2013 (Roser, 2017). Sub-Saharan Africa is considered as the least progressing country for reducing child mortality. However, Sub-Saharan Africa also showed increased rate of child survival between 1990-2000 and 2000-2011 reducing under-5 mortality by 39% between 1990 and 2011 (African Leadership for Child Survival, 2012*)*. Globally 16000 children die every single day with 11 deaths occurring each minute (WHO, 2017). In Sub-Saharan Africa 1 out of 12 children dies before their 5^{th} birthday, in South Asia 1 out of 19 and in high income countries 1 out of 147. In 2015, 6 million child deaths occurred out of which 30% happened in South Asian countries. From every 10 child deaths worldwide, three happen in South Asia (UNICEF, 2015).

2.1.1 Infant Mortality

According to Centre for disease and control (CDC), infant mortality is when a "child dies before reaching his/her first birthday". The Infant Mortality Rate (IMR) is rate of death of children before reaching their first birthday per 1000 live births (UN, 2000). Health of the infant effects older age groups in population. IMR is an important contributor for health development of entire population. Therefore, countries with limited resources can easily asses the health progress of population by simply calculating IMR (Reidpath et.al, 2003). In 2015, 4.5 million infant mortality occurred. However, the rate of infant mortality decreased worldwide from "63 deaths per 1000 live births in 1990 to 32 deaths per 1000 live births in 2015" (WHO, 2015).

2.1.2 Neonatal Mortality

"Death during first 28 days of life" is known as Neonatal Mortality and neonatal deaths per 1000 live births is known as Neonatal Mortality Rate(NMR) (Measure evaluation, n.d.). Globally, rate of neonatal mortality declined from 36 to 19 between the period of 1990-2015. Rate of decline for neonatal period is slower as compared to the post neonatal period. Out of 5.9 million child mortality in 2014, 1 million occurred during the first day and around 2 million during the "first seven days of life" (UNICEF, n,d.).

2.1.3 Who is most at risk?

Neonatal period (birth to first month of life) is the highest risk period for child mortality. Deaths in the neonatal period shares almost 60% of all the child deaths under age of 5 years (Bale et al., 2003). Ninety-nine percent of neonatal mortality occur in low and middle-income countries (Lawn et al., 2005). The reduction in the rates of neonatal mortality are slower in contrast to the post neonatal mortality in low and middle-income countries. On the basis of current progress, it can be projected that share of neonatal mortality in under- 5 deaths will jump from 45% in 2015 to 52% in 2030 (UN Interagency group, 2015).

2.1.4 Child Mortality in South Asia

South Asia (Afghanistan, Bhutan, India, Nepal, Sri Lanka, Pakistan, Bangladesh and Maldives) is region with one of the highest numbers of child mortality globally (UNICEF, 2016). According to UNICEF report (2015) on child mortality, out of 10 child deaths worldwide, three occur in South Asia. The under-5 mortality rate is still very high with 51 deaths per 1000 live births. There is not enough data available for the certified causes of death for under-5 mortality which makes it tough to assess the underlying causes.

South Asia has highest number of new born deaths, however since 1990 the number of newborn deaths have been halved. There is still need of serious efforts to achieve the sustainable target of newborn deaths as low as "12 per thousand live births" by 2030 (Guo, 2016).

2.2 Risk factors of under-5 Mortality in South Asia.

Mosely and Chen (1984) explained that child mortality in developing countries is a result of environmental, socio-economical, behavioral and biological factors. Moreover, Abir et al., (2015) also argued that the risk factors can also be either maternal, child or paternal characteristics. Here are some potential risk factors that can contribute to under-5 mortality.

2.2.1 Age of mother

Age of the mother is a major concern for gestational risk and child mortality (Ribeiro et al., 2014). Pregnancy during the adolescent and older age (>45) are harmful for the child and mother. The level of births in adolescent age have decreased worldwide since 1990 but still fertility in young age (11-19) contributes 11% of the births. Unfortunately, "95% of these births" happen in low and middle-income countries (WHO, 2014).

A study with participants from five birth cohorts in Guatemala, India, Brazil, South Africa and Philippines were evaluated for preterm birth, risk of low birth weight child, failure to complete schooling and lower adult height of children with age of mother. Increased risk factors for preterm birth were reported with increasing age of mother. Findings were more novel in Low and Middle-income countries (LMIC). However, children from older age mother were found to have better school progression and adult height attainment (Fall et al., 2015). Likewise, in Zimbabwe young mothers were found to have 33% increased risk for infant mortality as compared to the older age mothers (Dube et al., 2012).

Risk of infant mortality is more for the adolescent mothers having their first child. However, studies have also reported that the first-time mothers of age 27 or more can have child with increased risk for stunting, diarrhea and anemia. Increase in maternal age for the first birth might help to increase the chances of child survival (Finlay et al., 2011). Nigeria Demographic and Health Survey 2003 showed that median age of the pregnant mothers was found to be less than 19 and child mortality under the age of 5 was significantly associated with low age mothers (less than 20 years) (Ayotunde et al., 2009). Similarly, in Pakistan maternal age the delivery possess strong factor associated for child survival. Old (>35 years) and young (<20 years) age are high risk categories for child

bearing (Hanif, 2011). Renynolds (2006) also argued that in developing countries, mothers of age 18 or less show least care towards child than mothers between 19-21 years' age.

2.2.2 Type of place of residence

There is a rapid increase in urbanization all over the world. In 2014, the urban population worldwide jumped the mark of 54%. It has been predicted that soon mostly people will be concentrated in the urban areas globally especially in low and middle-income countries (UN, 2014).

According Global Health Observatory data (2013-2015) most of the child deaths happened in urban areas of low and middle-income countries. The difference in rural and urban child deaths varied from country to country however the difference in rural and urban areas was found to be at least "50 deaths per 1000 live births". A study from Kenya found that trends in childhood morality were found to be more in urban slum areas as compared to the rural and non-slum urban areas (Kimani-Murage et al., 2014*).* Another study from Bangladesh also reported similar results that under-5 mortality is significantly associated with the type of place of residence. Rates for child mortality were significantly higher for the rural mothers as compared to urban. Children brought up in urban areas had 66% more chances of survival as compared to the one in rural settings (Chowdhury, 2013). Stephenson et al. (2002) et al. argued that level of under-5 mortality in rural and urban areas depends largely on the economic status and ease to avail the health services.

The priority of urban areas for child survival does not necessarily guaranty the higher chances. Differences in socio-economic characteristics play an important role in Under-5 mortality. For analyzing the rural-urban impact on child mortality, it is also important to check socio-economic, demographic and behavioral factors that can help to explain the differences (Sastry, 1997).

2.2.3 Wealth Index

There are huge differences in levels of child mortality in poor and rich countries. Unfortunately, the gaps are also increasing between health of poor and rich children within a country. Poor children are more prone to get diseases as compared to the children of the same age but better financial position and even the subsidies benefit rich people more (Victora et al., 2003). Economic differentials are calculated on the basis of different determinants. The factors for evaluating differences between poor and rich should be wisely made. It is important for measuring the health inequalities and making health policies (Houweling et al., 2003). Comparison among nine different developing countries showed that economic inequalities favor the rich people in infant and under-5 mortality (Wagstaff, 2000).

In rural southern Tanzania, parents of the children from poorest background were found to be less likely to take their children to health care centers for any disease as compared to the rich. Children from rich background were found to have received proper medication and health care services (Schellenberg et al., 2003). Evidences from Demographic and Health Survey of 47 courtiers showed better health outcomes for rich children. Poorest population living in urban areas also need attention as the urban population grows (Van de Poel et al., 2007).

Barros et.al (2010) reviewed published data since 1990 on economic disparities related to morbidity and mortality within countries. It was found that poor children get more easily exposed to pathogens and have high chances of becoming ill. Once they become ill, chances of getting the quality health services are very low which leads to under-5 mortality. Likewise, Houweling et al., (2010) also argued that socio-economic factors causing child morality is an important public health concern in Low and middle-income countries (LMIC). Differences are huge between countries and also within countries.

2.2.4 Women's employment

Motherhood depends on the quality of care provided by mother on her child. Being an employed mother is tough responsibility especially for the health outcomes of underage children. Working mothers with a good adjustment between workplace and family can provide quality care for their children (Poduval et al., 2009). Earlier research from India showed that mortality rate of children under age of 5 is more for the employed mother (Sunita et al., 1998). A qualitative study conducted to observe the impact of maternal employment on nutritional and health status of child found that mothers working long hours effect the children's nutritional status and adequate care arrangements (Nair et al., 2017).

However, in some cases the prevalence of child mortality is lower for working mother than unemployed because working mothers have good financial status so they can afford better nutritional and health care services for their children (Adepoju et al., 2012).

2.2.5 Parental Education

Parental especially maternal education helps to improve the health outcomes. This simple relationship can be found in all countries despite differences in culture, living standards and schooling (Gakidou et al., 2010). Education of mother contributes to fertility and better economic outcomes. High education level of mother can help to make better child health, fertility and health seeking behavior (Grepin et al., 2015). Law for Compulsory primary education of mother was introduced in Turkey in order to improve child health. A cohort study on the effect of the Compulsory School Law was evaluated. Results from the study showed positive outcomes of mother's primary education on birth weight, height and health of child. Compulsory schooling also helped to improve the other health outcomes e.g. reduced smoking, fertility and increased age at first birth of mothers (Günes, 2015).

Along with the formal education, enhanced reading skills are also very much essential for mother and child survival. Good reading skills of mother can also help to reduce the child mortality (Greenaway, 2013). Economic prosperity and development in education of mother has helped to reduce child mortality in more than 60% counties of China (Wang

et al., 2016). Maternal education can give equal results whether in rural settings or urban slums. Even basic health education of the mother helps to increase vaccination coverage. (Johri et al., 2015). War and famine results in excessive child mortality. In war conditions, it was found the education level of the father plays an important role. Research from Africa showed that community prone to food crisis have high child mortality if mother and father are illiterate. Role of education especially father's education can help to reduce the child mortality in the areas devastated by war (Kiros et al., 2001).

Another study from Nairobi showed that education of mother is a potent indicator for child stunting. Higher maternal education results in lower stunting and improved child health (Abuya et al., 2012). Study from Bangladesh also showed a significant association of child's health with maternal education (Huq et al., 2008).

2.2.6 Sex of child

Health and child survival should have equity in policy. Difference in child mortality by sex are one of the important areas to focus. Sex differentials in under-5 mortality can vary from country to country. New-born female children have natural advantage over new-born boys for survival but in developing countries, like India and China, boys have relatively lower under-5 mortality rates in contrast to girls (UN, 2011). Similarly, another study from India also shows that female child mortality has always been higher than boys in north and central regions of India. Gender discrimination is evident cause for higher female under-5 mortality in India (Kuntla et al., 2014). However, trends in sex differential change in Sub-Saharan African region. A Research from Nigeria showed significantly higher risks of under-5 death for male children in comparison to female (Ezeh, 2015). Similar results were observed in another analysis from several countries of Sub-Saharan Africa that male children have significantly higher chances of mortality than girls before reaching age five (Boco, 2015).

2.2.7 Unintended Pregnancy

Untimed (expecting child before desired time) or unwanted pregnancy (time when no children were wanted or desired) is known as unintended pregnancy (CDC, n.d.). Out of 86 million pregnancies in 2012, 40% of them were unintended. Among those unintended pregnancies, 50% ended in abortion (unplanned birth: 30% and 13% miscarriage) (Sedgh et al., 2014).

Mothers tend to show less caring behavior towards health of unwanted child (Smith-Greenaway et al., 2016*)*. Unintended pregnancy also affects the health of mother. A study based on health of women with unintended pregnancies shows less intake of folic acid from the recommended dose, prenatal/post-partum smoking and depression (Cheng et al., 2009). Children from unintended pregnancies are at higher risk of receiving poor antenatal care in developing countries (Marston et al., 2003). Study from Ethiopia shows that most of the mothers with unintended pregnancy does not receive proper antenatal care resulting in adverse effects for mother and child health (Wado et al., 2013).

2.2.8 Contraceptive use

Family planning is useful to get the wanted number of children and also helpful in determining the space needed for next child. This can be achieved by the use of contraceptive methods. Use of contraceptives can be helpful in reducing the transmission of sexual related infections. 225 million women from the developing countries want to delay the process of carrying a child or want no child at all. If unintended pregnancy is prevented through contraceptives, rate of maternal and child mortality can also be reduced (WHO, 2016). Data from Demographic and Health Survey in Bangladesh showed that use of contraceptives can help to decrease "infant mortality of birth order 2 and higher by 7.9%". However, there is need for better understanding the causes influencing use of contraceptives (Saha et al., 2013). Children who born in less than an interval of two years than their oldest brother or sister have more chances to die as compared to those born after spacing of three years (Smith, 2009).

Use of contraceptives in developing countries over the past two decades has helped to cut down the maternal death by 40%, just by reducing the unintended pregnancy. Use of

modern contraceptive methods could also be really helpful for both mother and child life. Contraception can help to avoid the perinatal condition and death of child (Cleland, 2012). Study from Bangladesh shows that complete use of contraceptive methods can help to reduce the child mortality with a birth order of two or higher (Saha et al., 2013). Chola et al. (2015) argued that minimum investment in use of modern contraceptive methods can have a tremendous impact on child survival. Likewise, higher contraceptive use was also found to be associated as one of the key factors for reduction in child mortality in Afghanistan (Rasooly et al., 2014).

2.2.9 Smoking

Smoking tobacco cigarette is common but using non-smoking tobacco products is also very high in developing countries. Use of tobacco by women affects both mother and child during all stages of life (Sieminska, 2014). Epidemics of the tobacco is biggest threat for the health of public worldwide. Passive smoking also indirectly affects non-smokers and account for 28% of child death worldwide (WHO, 2017). Smoking for pregnant mother causes changes in placenta, altering the supply of oxygen and blood to the infant. This could result in complications for example baby can be separated from placenta very early causing low birth weight or even death (CDC, n.d.).

Smoking by mothers is strongly associated with the Sudden Infant Death Syndrome(SIDS). Risk of child death through passive smoking has increased a lot despite advice against this habit. Earlier study from the UK shows that the incidence of smoking during pregnancy has increased the SIDS. Exposure to the smoke can result in adverse physiological, anatomical and psychological changes (Fleming, 2007).Similarily, In Brazil increased cases of spontaneous abortion, early pregnancy, low weight and infant mortality were strongly found to be associated with maternal smoking (Levy et al., 2013). Wisborg et al. (2001) argued that 30-40% of the SIDS can be controlled if mothers stop smoking in population with 30% pregnant smokers. The prevalence of smoking tobacco among pregnant women in low and middle-income countries is lower as compared to developed countries. However, the percentage varies from country to country. Avoidance in using tobacco or prevention from second hand smoke can help to improve the health of mother and child (Caleyachtty et al., 2014).

2.3 Cause specific and all cause under-5 mortality

Mortality rate from a definite cause for a population is known as cause-specific mortality (State, n.d.). Globally for every 10 deaths, non-communicable conditions account for six, three for communicable, nutritional or reproductive and one for injuries. Two million under-5 deaths happened in 2015 and "2.7 million occurred in the neonatal period". Prominent causes leading to under-5 mortality were preterm birth issues, intrapartum related complications and pneumonia. The leading causes of child death in two regions with highest under-5 mortality were preterm birth issues in South Asia and Pneumonia in Sub-Saharan Africa. Preterm birth related issues were important cause in all high, medium high and medium under-5 mortality effected countries, while congenital issues were for the countries with very low or low under-5 deaths. (Liu et al., 2016). Diarrhea was also marked as an important cause of child mortality in 2015 (Wang et al., 2016). According to CDC (Centre for Disease Control and Prevention) diarrhea accounts for death of one in nine children (CDC, n.d.). All countries performed well for prevention of infectious diseases causing child mortality. However, the progress in cause-specific under-5 mortality varied from country to country in 2015. Progress for pneumonia related deaths was not appreciable as compared to that of diarrhea or other causes (Cha, 2016). Predominantly six conditions are responsible for more than 70% of the under-5 mortality worldwide: "pneumonia (19%), diarrhea (18%), malaria (8%), measles, (4%), HIV/AIDS (3%), and neonatal issues such as birth asphyxia, pre-term birth, and infections (37%)". HIV/AIDS is also becoming one of the prominent cause for infant deaths in Sub-Saharan Africa. Malnutrition also majorly accounts for the neonatal deaths (WHO, 2011).

2.4 Global Response (MDG and SDG)

In the beginning of new millennium, leaders of the world gathered and signed eight millennium development goals supported by all the countries of world and development institutions. Goal 4 of the eight MDGs was to reduce the child mortality by two third globally especially in the developing countries during the period of 1990 and 2015 (UN, n.d.). Under-5 mortality was reduced by 53% in 25 years, thus MDG4 target was not achieved. However, "sixty-two countries achieved the MDG4 target of reducing, among them twenty-four were low and middle-income countries (You et al., 2015). Sub-Saharan Africa was the region with least development in child mortality during the MDG era,

frequently marked as “off-track”. Though the Sub-Saharan Africa did not achieve the target yet the progress towards child survival was most prominent in all aspects since 2000-2015 (Cha, 2017).

Post-2015 era marked the start of Sustainable development goals (SDGs) (UN, 2015). The SDGs target is to decrease under-5 mortality by not more than “25 per 1000 live births and infant mortality less than 12 per 1000 live births” (Liu et al., 2016). The number of children dying every day has reduced incredibly since 1990 but still the number of dying children under the age of 5 is more than six million per year. Unfortunately, four out of every five deaths occur in Southern Asia and Sub-Saharan Africa (UN, n.d.) Serious efforts to maintain the disease control and prevention programs for rapid reduction in Under-5 mortality is needed. Joint and integrated actions can help to achieve the SDG goal by 2030 (Glass et al., 2012). While formulating strategies, all countries should keep in focus the under-5 mortality and cause of death profile (Liu et al., 2016).

2.5 Summary table of the reviewed literature

Table 1: Summary of reviewed Literature

Last name of first author and the study year	Title of the study	Study design	Main findings		
			Outcome	**Risk factors studied**	**Main Result/s**
D.D. Reidpath (2003)	Infant mortality rate as an indicator of population health	Cross-sectional	IMR is an key factor for health of overall population		Linear association between disability adjusted life expectancy (DALY) and Infant mortality rate(IMR)
Bale JR (2003)	Improving birth outcomes: meeting challenges in developing world	Review report	Surveillance and investigation of fetal mortality can assist to formulate interventions for improving birth outcomes in developing countries.	Advance maternal age, chronic maternal conditions, maternal infections, inadequate maternal nutrition and maternal complications	
F.D. Ribeiro (2014)	Extremes of maternal age and child mortality	Cross-Sectional	Adolescent and old age mothers require special social and medical	Congenital anomalies	increased number of child deaths for mother's adolescent(<18year) and old age mother (>35 years)

			services for health of child and mother.	
Finlay JE (2011)	Association of maternal age with infant mortality, child anthropometric failure, diarrhea and anemia for first births	Cross-sectional	Increasing the age of mother during the first birth in developing countries can help to control the child mortality	Infant deaths are lowest between the maternal age of 27 and 29
Ayotunde T (2009)	Maternal age at birth and under-5 mortality in Nigeria	Cross Sectional	Maternal education can help to improve the decline of under-5 mortality in Nigeria.	Young mother and mothers above 35 years of age exhibit significant risk for under-5 mortality
H.M. Hanif (2011)	Association between maternal age and pregnancy outcome, implications for Pakistani Society	Cross sectional	Younger and old age mothers are highest risk for child mortality in Pakistan	Trend of increasing maternal age at conception.
E.W. Kimani-Murage (2014)	Trends in child mortality in Kenya-The urban advantage has seemingly been wiped out	Cross sectional	Extra care needs to be given on the poor conditions of slums in urban areas	Decline in under-5 mortality for both urban and rural areas and also urban slums between 1993-2010

A.H. Chowdhury (2013)	Determinants of under-5 Mortality in Bangladesh	Cross sectional	Increasing paternal care, more civic facilities in rural areas, using modern contraceptives, full breast-feeding practices could help to reduce under-5 mortality in Bangladesh	Father's education, place of residence, region of residence, previous death of sibling, mother's age and breastfeeding	Under-5 mortality is effected independently as well as indirectly by socio-economic factors.
C.G. Victora (2003)	Applying an equal lens to child health and mortality- more of the same is not enough	Cross sectional	Directing the policies for poor people can help to formulate health equity		Children with poor family background are more likely to be exposed to health risks
T.A. Houweling (2003)	Measuring health inequality among children in developing countries: does the choice of the indicator of economic status matter?	Cross sectional	Policy makers should know that the differences between countries can be a product of wealth measures used		Poor-rich inequalities vary and differ from country to country
A. Wagstaff (2000)	Socio-economic inequalities in child mortality- comparisons	Longitudinal	Policies regarding wealth differentials and their impact on under-5		Wealth differentials helps better-off and vary among different countries

	across nine developing countries		mortality needs special attention in all countries	
E.Van De Poel (2007)	Are Urban Children really healthier? Evidence from 47 developing countries	Cross-sectional	There is a requirement for programs targeting the poor in urban areas	Numerous countries have higher child mortality rates for urban poor than rural.
F.C. Barros (2010)	Socio-economic inequalities in health and nutrition of children in low and middle-income countries	Cross sectional	Careful documentation at each stage of socio-economic situations effecting child mortality is needed.	Children from poor families are at higher risk of getting pathogenic infections
A.J. Houweling (2010)	Socio-economic inequalities in child mortality in low and middle-income countries- a review of international evidence	Review report	Child mortality is considerably high in low socio-economic groups	Political attention is needed for addressing health inequalities and to make sure interventions reach the lower socio-economic group
J. Poduval (2009)	Working mother: How much working, How much mothers, and where is the Womanhood?	Review report	Substantial changes are required at workplace and individual level to aid mothers being a	

			good mother and excel in work at same time		
M. Nair (2017)	Impact of mothers' employment on infant feeding and care: a qualitative study of the experiences of mothers employed through the Mahatma Gandhi National Rural Employment Guarantee Act	Qualitative study	Mother's employment effects the child health		Policy changing regarding upgrade of working conditions is required
A.O ADEPOJU (2012)	Determinants of child mortality in rural Nigeria	Cross sectional		Maternal education, birth interval, place of delivery, type of birth, child ever breastfed, sex of child,	Maternal education, access to health care, and increased awareness of facts of breastfeeding are prominent factors for under-5 mortality
Gakidou. E (2010)	Increased educational attainment and its effect on child mortality in 175 countries	Cross sectional	Of 8·2 million fewer deaths in children younger than 5 years between 1970 and 2009, we estimated that 4·2		Increase in the educational level of women can help to reduce the child mortality

		million (51·2%) could be attributed to increased educational attainment in women of reproductive age	
K.A. Grepin (2015)	Maternal education and child mortality in Zimbabwe	Maternal secondary education is associated with 21% decline in child mortality	Access to secondary education for mothers may help to reduce child mortality
P.M. Gunes (2015)	The role of maternal education in child health-Evidence from a compulsory schooling law	Education of mother improves health of child even when health services are easily available	Mother's primary school education decreases the death rate of infants
E.S. Greenaway (2013)	Maternal reading skills and child mortality in Nigeria: A reassessment of why education matters	There is a need for more data on how literacy of mother reduces child mortality	Formal schooling of mothers even at primary level is associated with lower risks of child mortality
Y. Wang (2016)	Under-5 mortality in 2851 Chinese counties, 1996–2012: a subnational	Under-5 Mortality is reducing at 8.8% twice	Lessons from successful counties in China can be used to lower under-5

	assessment of achieving MDG 4 goals in China		than MDG4 pace in all counties of china		mortality in counties with less progress
G.E. Kiros (2001)	War, famine and excess child mortality in Africa: the role of parental education	Cross sectional	Role of education in reducing child mortality during famine period is remarkable		Expansion of educational opportunities are required to reduce child mortality
M. Nazmul Huq (2008)	Maternal Education and Child Healthcare in Bangladesh	Cross sectional		Quality of child health care services, vaccination, maternal education	Health awareness campaigns should be strengthened
S. Kuntla (2014)	Explaining sex differentials in child mortality in India	Cross sectional	Mortality in female child is more as compared to the female		Efforts for increasing child survival should focus more or within female child disparity
Saha UR (2013)	Contraceptive use, birth spacing, and child survival in Matlab, Bangladesh	Cross sectional	Using contraceptive can reduce the child mortality of birth order 2 and higher by 7.9%.		Contraceptive use help in birth spacing and ultimately child survival
A. Sieminska (2014)	The many faces of tobacco use among women	Cross sectional study	Active or passive smoking disturbs women during pregnancy and also		Factors contributing towards vulnerability of women to smoke needs more attention

			affect the newborn health	
K. Wisborg (2001)	A prospective study of smoking during pregnancy and SIDS (Sudden Infant Death Syndrome)	Prospective follow-up study	Children of smokers have three times more risk of SIDS as compared to non-smokers	Child deaths can be decreased if pregnant mothers stop smoking
T. Abir (2015)	Risk factors for under-5 mortality: evidence from Bangladesh Demographic and Health Survey, 2004–2011	Cross sectional	Under-5 mortality decreased between the period of 2004-2011 in Bangladesh	Interventions focusing on family planning and contraceptive methods are required to further reduce child mortality

3. AIMS AND OBJECTIVES

The main aim of the study is to assess the prevalence and socio-demographic risk factors associated with under-5 mortality in WHO South Asian region (Bangladesh, India, Maldives, Nepal and Pakistan). Specific objectives of the study are:

- To determine the overall (regional) and country-specific prevalence of under-5 mortality in South Asian countries.
- To study overall and country-specific, risk factors associated with Under-5 mortality in South Asia.

4. METHODS

4.1 Data Source

This study is based on Demographic and Health Survey (DHS), data collected from five South Asian countries (Bangladesh, India, Maladies, Nepal and Pakistan). DHS collects data using similar standard protocol from most of the low and middle-income countries to facilitate the comparability among countries. It covers wide range of topics like family planning, maternal and child health, fertility, gender, malaria, HIV/AIDS and nutrition. Information of the DHS are available elsewhere (DHS Program, 2017). Consent to use the data was granted by Measure DHS. Data was available publicly and no further permission for usage was required from the individual countries.

4.2 Sampling Techniques

DHS uses two-stage cluster design for nationally representative population survey. A subset of geographical clusters with respect to population is selected in the first stage while in the second stage from complete listing of household's sample of households is shortlisted. Sometimes, three stage process is used for selection of clusters. Unlike random sampling, cluster sample technique takes a dispersed sample of all households in country and is logically acceptable to perform survey within a limited cost and time.

4.3 Study Population

Data was obtained from the most recent live under-5 births from mothers within 5 years prior to the survey. Information was collected with the help of a structured questionnaire which was used to interview all the participants. There are normally three types of questionnaire: Men's questionnaire, women's questionnaire and household questionnaire. In the women's questionnaire, usually 5000-10000 women between the age of 15-49 participate. Survey collected retrospective data on birth histories that are being used to define child mortality. All the information was processed in the form of a final survey report to evaluate the information on specific indicators in a country. We used the nationally representative "Birth Record" DHS data of five countries in WHO South Asian region between 1999-2014. Individual datasets from each country were

pooled to form a single data set for extrapolating the estimates of under-5 mortality. Information from 570676 women was collected in total :89833(15.7%) from Bangladesh, 291816(51.1%) from India, 19166(3.4%) from Maldives, 81966 (14.4%) from Nepal and 87917(15.4%) from Pakistan.

Ethical consent was approved by the concerned institutions in the studied countries. Written consent was given by all respondents. All participants gave permission to use data for research and publication purposes.

4.4 Measurement of variables

4.4.1 Under-5 mortality

Under-5 Mortality was the outcome variable in this study defined as death of children from day of birth to fifth birthday of child. The evidence about the date of birth (year and months), survival status, age at death or current age was present in the data.

4.4.2 Independent Variables

The demographic variables analyzed in this study were: age of mother (in 5 year groups: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49), type of place of residence (rural, urban), wealth index (poor, middle, rich), respondent currently working (no, yes), highest education level of mother (no education, primary, secondary, higher), husband/partner highest year of education (no education, primary, secondary, higher), sex of child (male, female), contraceptive use (using modern method, using traditional method, non- user intends to use later, does not intend to use), Wanted Child (Wanted, Wanted later, Wanted no more) and Using tobacco was categorized as (“yes” or “no”).

4.5 Statistical Analysis

Dataset from each individual country were merged into one single dataset. Weighting of the sample was done to account the complex sampling strategy of DHS. The outcome variable in this study was under-5 mortality. For the estimation of under-5 mortality, survival time was calculated based on the survival status of child. If the child is alive,

survival time was considered to be the difference between date of interview and date of birth and if dead the survival time was supposed to be age at death in days. After that, survival time was divided by 30.42 to convert the days into months.

Imputation and deletion of missing procedures was conducted by DHS before availability of data publicly. For calculating association of outcome variable with socio-demographic variables, we used Cox Proportional hazard method along with hazard ratio (HR) at a confidence interval (CI) of 95%.

Cox regression analysis were performed in two different models. Model 1 (Bivariate) was the basic association between the independent and outcome variable. In Model II, all the studied variables were included together to compute the predictive of each variable when adjusted collectively. Adjusted hazard ratio was first calculated for the total sample with each of the socio-demographic variable. After that, we also investigated country level hazard ratio with their 95% CI to find out the association of under-5 mortality with all studied socio-demographic variables.

Kaplan Meier curves for the effect of socio-demographic variables on under-5 mortality was drawn to show time to event pattern and the curves were drawn separately for each country to estimate the likelihood of occurrence for outcome variable with respect to each country. SPSS 21 and STATA 14 were used to analyze the data for this study.

5. RESULTS

5.1 Prevalence of under-5 mortality in pooled dataset

Table 2 shows the prevalence of under-5 mortality by socio-demographic characteristics. In general, the prevalence of under-5 mortality was significantly increased with increasing maternal age, the highest prevalence among 45-49 years' age group (13.2%) women, while the lowest prevalence among 20-24 years' age group (7.3%).

The children of rural residents' women had significantly higher mortality compared to urban residents (10.9% vs. 7.4%). Wealth index also exhibits a significant difference for the under-5 mortality with highest prevalence among poor women compared to the middle (9.6%) and rich (6.6%) women. Similarly, significantly higher mortality was found among working women compared to the non-working women (11.4% vs. 9.0%).

Children of mothers with no education had highest prevalence of under-5 mortality (12.4%) while women with highest education level had only 3.3% under-5 mortality. Likewise, husband's education also showed similar effect on the prevalence of under-5 mortality compared to female counterparts. Male children showed significantly higher under-5 mortality than female (10.2% vs. 9.8%).

Children of women with unwanted children had highest under-5 mortality compared to women with unwanted children (10.1% vs 9.9%). The intention of contraceptive use also makes a marked difference in prevalence of under-5 deaths with highest prevalence (13%) among non-user and (8.2%) among modern method users. Likewise, high incidence of under-5 mortality was reported among mothers using tobacco (13.9%) in contrast with non-user (9.4%).

Table 2: Prevalence of Under-5 Mortality according to sociodemographic characteristics in pooled data set

Characteristics	**N**	**Under-5 mortality**		
	562412	**No= 506042**	**Yes=56370**	***P* value**
Age in 5 year groups	562411			<0.001
15-19	8272	7637(92.3%)	635(7.7%)	
20-24	49809	46154(92.6%)	3655(7.3%)	
25-29	91681	84530(92.1%)	7151(7.8%)	
30-34	106875	97173(90.8%)	9702(9.1%)	
35-39	111267	99967(89.7%)	11300(10.2%)	
40-44	103994	91994(88.3%)	12000(11.5%)	
45-49	90513	78587(86.6%)	11926(13.2%)	
Type of place of residence	562411			<0.001
Urban	140246	129855(92.6%)	10391(7.4%)	
Rural	422165	376186(89.1%)	45979(10.9%)	
Wealth Index	562411			<0.001
Poor	269197	235442(87.2%)	33755(12.5%)	
Middle	107390	97129(90.4%)	10261(9.6%)	
Rich	185824	173470(93.4%)	12354(6.6%)	
Respondent currently working	561812			<0.001
No	325736	296259(90.1%)	29447(9.0%)	
Yes	236076	209241(88.6%)	26835(11.4%)	
Highest Education Level	562410			
No Education	334009	292657(87.6%)	41352(12.4%)	
Primary	100901	92420(91.6%)	8481(8.4%)	
Secondary	109382	103436(94.6%)	5946(5.4%)	
Higher	18118	17528(96.7%)	590(3.3%)	
Husband/partner highest year of education	562409			<0.001
No education	210040	183629(87.4%)	26411(12.6%)	
Primary	115976	103965(89.6%)	12011(10.4%)	
Secondary	187924	172590(91.8%)	15334(8.2%)	
Higher	48469	45857(94.6%)	2612(5.4%)	
Sex of child	562410			<0.001

Male	290864	261237(89.8%)	29627(10.2%)	
Female	271546	244804(90.2%)	26742(9.8%)	
Wanted last child	238124			<0.001
Wanted	158872	143210 (90.1%)	15662(9.9%)	
Wanted later	22925	21335(93.1%)	1590(6.9%)	
Not wanted	56327	50595(89.8%)	5732(10.2%)	
Contraceptive use	562411			<0.001
Using modern method	271653	249308(91.8%)	22345(8.2%)	
Using traditional method	43663	39524(90.5%)	4139(9.5%)	
Non-user intends to use later	107001	95786(89.5%)	11215(10.5%)	
Does not intend to use	140094	121424(86.7%)	18670(13.3%)	
Tobacco Use	562410			<0.001
Yes	79327	68332(86.1%)	10995(13.9%)	
No	483083	437709(90.6%)	45374(9.4%)	

5.2 Country-specific prevalence of Under-5 mortality and associated risk factors in South Asia

Table 3 presents the prevalence of under-5 mortality in five South Asian Countries (Bangladesh, India, Maldives Nepal and Pakistan) and associated socio demographic characteristics. Nepal (figure 1) had higher prevalence of under-5 mortality followed by India and Pakistan.

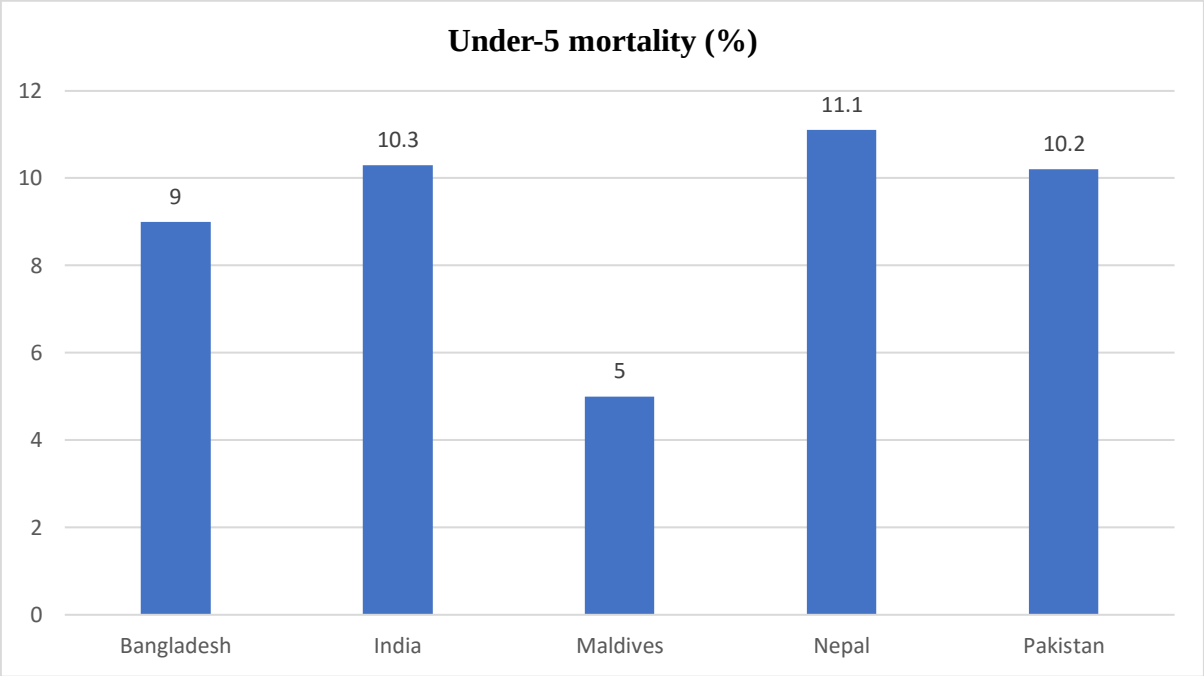

Figure 1:Prevalence of under-5 mortality in South Asia

In general, the prevalence of under-5 mortality was increased with increasing maternal age with the highest prevalence among the oldest age group in all countries. Nepal and Pakistan had higher prevalence of under-5 mortality in each group as compared to the other countries studied.

Women from rural areas had increased prevalence of under-5 mortality compared to the urban residents in all countries. Similarly, poor women in all countries were reported to have highest under-5 mortality with maximum prevalence in India. Likewise, Pakistan had the highest under-5 deaths for working women.

Highest education level of mother or husband was reported to have lowest mortality rates with Maldives having least mortality amongst all countries. All countries showed more under-5 mortality for male child in comparison to the female counterparts. Women with unintended birth had higher prevalence of under-5 mortality in all countries except Pakistan. Individuals who did not intend to use contraceptive had increased occurrence of under-5 mortality in each country. Under-5 mortality was highest in all countries for mothers using tobacco with exception in Maldives with least prevalence.

Table 3: Cross-country association between socio-demographic characteristics and Under-5 Mortality

Characteristics	**Bangladesh**		**India**		**Maldives**		**Nepal**		**Pakistan**	
	Total	**Under5**	**Total**	**Under5**	**Total**	**Under5**	**Total**	**Under5**	**Total**	**Under5**
	88969	**Mortality**	**287229**	**Mortality**	**19013**	**Mortality**	**80118**	**Mortality**	**87083**	**Mortality**
		7966(9.0%)		29620(10.3%)		958(5.0%)		8912(11.1%)		8914 (10.2%)
Age of mother	**n=88968**		**n=287228**		**n=19013**		**n=80117**		**n=87082**	
15-19	2440	125(5.1%)	4068	356(8.8%)	29	0(0.0%)	1170	88(7.5%)	564	66(11.7%)
20-24	9211	499(5.4%)	27303	2133(7.8%)	856	17(2.0%)	7327	559(7.6%)	5111	447(8.7%)
25-29	14672	924(6.3%)	49504	3968(8.0%)	2186	37(1.7%)	13201	1042(7.9%)	12118	1180(9.7%)
30-34	16290	1199(7.4%)	56353	5316(9.4%)	3138	101(3.2%)	14382	1355(9.4%)	16712	1732(10.4%)
35-39	15241	1346(8.8%)	57765	6214(10.8%)	4127	181(4.4%)	15473	1716(11.1%)	18662	1844(9.9%)
40-44	15972	1824(11.4%)	51278	6186(12.1%)	4727	286(6.1%)	15213	1975(13.0%)	16803	1728(10.3%)
45-49	15142	2049(13.5%)	40957	5447(13.3%)	3950	336(8.5%)	13351	2177(16.3%)	17112	1916(11.2%)
Type of place of residence	**88969**		**287229**		**19013**		**80117**		**87082**	
Urban	21103	1647(7.8%)	78163	5673(7.3%)	5115	173(3.4%)	8365	623(7.4%)	27499	2274(8.3%)
Rural	67866	6319(9.3%)	209066	23947(11.5%)	13898	785(5.6%)	71752	8288(11.6%)	59583	6640(11.1%)
Wealth Index	**88968**		**287229**		**19014**		**80117**		**87081**	
Poor	37869	3966(10.5%)	135121	18016(13.3%)	8457	487(5.8%)	50829	6558(12.9%)	36920	4727(12.8%)
Middle	18166	1677(9.2%)	56194	5488(9.8%)	4043	255(6.3%)	11010	1081(9.8%)	17976	1760(9.8%)
Rich	32933	2322(7.1%)	95914	6116(6.4%)	6514	217(3.3%)	18278	1273(7.0%)	32185	2426(7.5%)

Respondent Currently Working	88960		28683		18942		80117			
No	68090	5974(8.8%)	16647	15645(9.4%)	11763	588(5.0%)	17922	1579(8.8%)	61483	5690(9.3%)
Yes	20870	1992(9.5%)	120358	13935(11.6%)	7179	363(5.1%)	62195	7332(11.8%)	25474	3213(12.6%)
Education Level	**88970**		**287228**		**19013**		**80117**		**87082**	
No education	33157	3939(11.9%)	172229	22048(12.8%)	8444	594(7.0%)	59353	7694(13.0%)	60825	7077(11.6%)
Primary	28726	2596(9.0%)	42371	3733(8.8%)	7213	319(4.4%)	10787	785(7.3%)	11805	1048(8.9%)
Secondary	23291	1293(5.6%)	63873	3586(5.6%)	3004	45(1.5%)	8828	395(4.5%)	10385	627(6.0%)
Higher	3796	138(3.6%)	8755	253(2.9%)	352	0(0.0%)	1149	38(3.3%)	4067	162(4.0%)
Husband/Partner education level	**88968**		**287229**		**19012**		**80118**		**87082**	
No Education	33683	3738(11.1%)	100360	13264(13.2%)	11545	723(6.3%)	29499	4328(14.7%)	34953	4358(12.55)
Primary	24919	2199(8.8%)	50731	5644(11.1%)	4327	171(4.0%)	21635	2437(11.3%)	14363	1560(10.9%)
Secondary	21501	1577(7.3%)	113005	9536(8.4%)	2701	59(2.2%)	24282	1900(7.8%)	26435	2262(8.6%)
Higher	8865	452(5.1%)	23133	1175 (5.1%)	439	4(0.9%)	4702	247(5.3%)	11331	734(6.5%)
Sex of Child	**88969**		**287228**		**19013**		**80117**		**87083**	
Male	45688	4288(9.4%)	149329	15402(10.3%)	9700	518(5.3%)	40987	4647(11.3%)	45160	4772(10.6%)
Female	43281	3678(8.5%)	137899	14217(10.3%)	9313	440(4.7%)	39130	4265(10.9%)	41923	4142(9.9%)
Wanted last child	**27610**		**114842**		**7781**		**38149**		**49743**	
Wanted	17510	1290(7.4%)	80934	8152(10.1%)	4598	132(2.9%)	21115	2280(10.8%)	34717	3810(11.0%)
Wanted Later	3636	218(6.0%)	9547	670(7.0%)	765	23(3.0%)	3545	262(7.4%)	5433	417(7.7%)
Not wanted	6464	508(7.9%)	24361	2719(11.2%)	2418	100(4.1%)	13489	1519(11.3%)	9593	885(9.2%)

Contraceptive Use and Intention	**88968**		**287227**		**19015**		**80118**		**87083**	
Using modern method	45288	3345(7.4%)	156862	12936(8.2%)	6879	370(5.4%)	36573	3354(9.2%)	26051	2339(9.0%)
Using traditional method	9043	849(9.4%	21433	2248(10.5%)	1286	42(3.3%)	3640	290(8.0%)	8259	709(8.6%)
Non-user intends to use later	12752	1008(7.9%)	50205	5753(11.5%)	2408	106(4.4%)	22647	2427(10.7%)	18990	1922(10.1%)
Does not intend to use	21885	2763(12.6%)	58727	8682(14.8%	8442	441(5.2%)	17258	2841(16.5%)	33783	3944(11.7%)
Does not use tobacco			**276429**		**18970**		**80117**		**48615**	
No	N/A	N/A	46335	6342(13.7%)	3008	251(8.3%)	25548	3731(14.6%)	4436	671(15.1%)
Yes, Smokes nothing	N/A	N/A	230094	22025(9.6%)	15962	703(4.4%)	54569	5180(9.5%)	44179	4418(10.0%)

5.3 Association of under-5 mortality with socio-demographic characteristics in pooled data

Table 4 shows the crude and adjusted association of under-5 mortality for socio-demographic characteristics. Model 1 presents the bivariate and model 2 shows multivariate association. Among socio-demographic characteristics, compared to the youngest age group, children of the mothers age up to 35 years were significantly associated with lower risk of under-5 mortality. However, older age group had the increased risk of under-5 mortality. Similar associations of maternal age with under-5 mortality was found in multivariable model (model II) (HR for 45-49 years: 1.38, 95% CI:1.24-1.52). Children of women residing in rural settings had 48% higher risk of under-5 mortality (R:1.48 95% CI: 1.45-1.51) compared to the urban resident in bivariate model. However, in multivariable model, no difference was found between rural and urban residents' women. Children of women from rich wealth index had reduced risks of under-5 mortality compared to the poor. Similar associations were also found in multivariable model (HR for rich: 0.70, 95% CI: 0.68-0.72).

For both models, working women were reported to have significantly increased risk of under-5 mortality. Highest level of maternal education decreases the risk under-5 mortality both in bi-variable (HR for highest level of maternal education R: 0.20, 95% CI: 0.19-0.22) and multivariable models (HR for highest level of maternal education R: 0.36, 95% CI: 0.32-0.40) in contrast to lower education. Likewise, education level of the husband also makes same difference in both models. Female children also found to have less risk of under-5 mortality in bi-variate and multi-variable model in contrast to their male counterparts.

Among the categories of wanted child, mother who don't wanted child had highest risk of under-5 mortality (HR: 1.05 95% CI: 1.01-1.09) but the multivariable model assessed 0.85 times less risk of under-5 mortality (For mothers with unwanted child: HR:0.92 95%CI: 0.87-0.97).

Women who did not intend to use contraceptive were at highest risk of under-5 mortality than others (HR:1.68 95% CI:1.64-1.72). Similarly, significant association of not using contraceptives with under-5 mortality was found in model II. Bi-variate model showed

the mothers not using tobacco at highest risk (HR: 1.50 95% CI: 1.47-1.54) of mortality then those who don't whereas multivariable model reported the significant lowest risk for non-smoking mothers (HR: 0.85 95% CI: 0.83-0.87).

Table 4: Associations of risk factors with under-5 mortality. Hazard ratios (HR), and their 95% confidence intervals (CIs) adjusted for socio-demographic variables

Characteristics	Model I		Model II	
	HR (95%CI)	P -value	HR (95%CI)	P-Value
Age in 5-year groups				
15-19	Reference		Reference	
20-24	0.82(0.74-0.91)	<0.001	0.85(0.76-0.94)	0.002
25-29	0.80(0.73-0.89)	<0.001	0.85 (0.77-0.95)	0.002
30-34	0.90(0.81-0.99)	0.038	0.96 (0.87-1.07)	0.493
35-39	1.01(0.92-1.12)	0.789	1.07(0.92-1.18)	0.184
40-44	1.19(1.08-1.31)	0.001	1.23 (1.11-1.36)	<0.001
45-49	1.37(1.25-1.51)	<0.001	1.38(1.24-1.52)	<0.001
Type of place of residence				
Urban	Reference		Reference	
Rural	1.48(1.45-1.51)	<0.001	0.99 (0.96-1.013)	0.339
Wealth Index				
Poor	Reference		Reference	
Middle	0.71(0.69-0.73)	<0.001	0.81(0.79-0.83)	<0.001
Rich	0.47 (0.46-0.48)	<0.001	0.70(0.68-0.72)	<0.001
Respondent Currently Working				
No	Reference		Reference	
Yes	1.31(1.28-1.33)	<0.001	1.09(1.07-1.12)	<0.001
Husband/partner education level				
No education	Reference		Reference	
Primary	0.82(0.80-0.84)	<0.001	0.97(0.94-0.99)	0.008
Secondary	0.58(0.56-0.59)	<0.001	0.87(0.85-0.90)	<0.001
Higher	0.35(0.34-0.37)	<0.001	0.74(0.70-0.78)	<0.001
Highest Education Level				
No Education	Reference		Reference	
Primary	0.65(0.64-0.67)	<0.001	0.80(0.78-0.82)	<0.001
Secondary	0.40(0.38-0.41)	<0.001	0.60(0.58-0.62)	<0.001
Higher	0.20(0.19-0.22)	<0.001	0.36(0.32-0.40)	<0.001
Sex of Child				
Male	Reference		Reference	

Female	0.97(0.95-0.99)	0.002	0.95 (0.93-0.97)	<0.001
Wanted last child				
Wanted	Reference		Reference	
Wanted later	0.69(0.64-0.73)	<0.001	0.72(0.66-0.79)	<0.001
Not wanted	1.05(1.01-1.09)	0.008	0.92(0.87-0.97)	0.003
Contraceptive Use				
Using modern method	Reference		Reference	
Using traditional method	1.08 (1.03-1.12)	<0.001	1.11 (1.06-1.15)	<0.001
Non-user intends to use later	1.39 (1.35-1.42)	<0.001	1.29(1.25-1.32)	<0.001
Does not intend to use	1.68(1.64-1.72)	<0.001	1.33(1.30-1.37)	<0.001
Use tobacco				
Yes	Reference		Reference	
No	1.50 (1.47-1.54)	<0.001	0.85(0.83-0.87)	<0.001

†The difference was tested using Chi-square test.

Model I: Crude Hazard ratio

Model II: Simultaneously adjusted for all variables used in the analysis i.e. (Age of mother, Place of residence, wealth index, currently working respondent, education of mother, education of husband/Partner, sex of child, wanted last child, contraceptive and tobacco use)

5.4 Country-specific association of Under-5 mortality with socio-demographic characteristics

Table 5 shows the adjusted country wise association of under-5 mortality adjusted for socio-demographic characteristics. Maternal age follows the pattern of higher under-5 mortality with lower age for all countries with Bangladesh showing highest risk of mortality for the mothers above 45 years of age (HR:1.97, 95% CI:1.35-2.88). Respondents from rural settings does not show significant association for any of the country. Mothers of the children from rich background have least mortality in all studied countries. Currently working women showed significant association with output (under-5 Mortality) highest prevalence in Pakistan (HR:1.30 95% CI: 1.22-1.40). Risk for prevalence of under-5 mortality decreased in all countries as the maternal level of education increased. Similarly, education level of husband also reported to have same results for every country except Maldives that did not show a significant association for level of education with under-5 mortality. India and Pakistan showed significant increased risk of death for female children under five years of age but rest of countries

did not show significant association. Every country excluding Maldives showed a significantly lower risk of death for mothers who did not want child as compared to those who wanted. Likewise, all countries had highest risk of under-5 mortality for mothers not intended to use contraceptives while Maldives did not show a significant association. Smoking mothers also showed a significant risk of under-5 mortality in all countries.

Table 5: Country wise risk factors of Under-5 mortality. Hazard ratios(HR), and their 95% confidence intervals (CIs) adjusted for the socio-demographic characteristics

	HR 95% CI									
Characteristics	**Bangladesh**		**India**		**Maldives**		**Nepal**		**Pakistan**	
	HR	***P*-Value**	**HR**	***P*-Value**	**HR**	***P*-Value**	**HR**	***P*-Value**	**HR**	***P*-Value**
Age of mother										
15-19	Reference	NA	Reference	NA	NA	NA	Reference	NA	Reference	NA
20-24	0.95(0.75-1.19)	0.645	0.89(0.76-1.04)	0.133	NA	NA	0.68(0.53-0.86)	0.001	0.93(0.66-1.29)	0.652
25-29	0.99(0.79-1.25)	0.977	0.90(0.78-1.04)	0.185	NA	NA	0.67(0.54-0.85)	0.001	0.98(0.71-1.37)	0.929
30-34	1.13(0.89-1.43)	0.313	1.02(0.88-1.19)	0.728	NA	NA	0.83(0.65-1.04)	0.113	1.01(0.73-1.41)	0.925
35-39	1.32(1.02-1.70)	0.034	1.16(1.00-1.36)	0.048	NA	NA	0.97(0.76-1.23)	0.798	0.90(0.65-1.25)	0.532
40-44	1.54(1.14-2.07)	0.004	1.17(0.99-1.39)	0.064	NA	NA	1.05(0.82-1.34)	0.708	0.99(0.71-1.39)	0.974
45-49	1.97(1.35-2.88)	<0.001	1.31(1.07-1.60)	0.008	NA	NA	1.11(0.84-1.45)	0.471	0.95(0.67-1.35)	0.790
Type of place of residence										
Urban	Reference		Reference		Reference		Reference		Reference	
Rural	0.98(0.86-1.12)	0.840	0.99(0.94-1.06)	0.910	0.65(0.29-1.41)	0.272	1.04(0.92-1.17)	0.517	1.00(0.92-1.08)	0.998
Wealth Index										
Poor	Reference		Reference		Reference		Reference		Reference	

Middle	0.84(0.73-0.97)	0.016	0.79(0.74-0.85)	<0.001	0.94(0.67-1.31)	0.698	0.91(0.80-1.03)	0.144	0.85(0.78-0.93)	<0.001
Rich	0.87(0.76-1.01)	0.058	0.68 (0.63-0.74)	<0.001	0.54(0.28-1.04)	0.067	0.89(0.78-1.03)	0.121	0.82(0.74-0.90)	<0.001
Respondent currently working										
No	Reference		Reference		Reference		Reference		Reference	
Yes	1.13(0.98-1.28)	0.077	1.04(0.99-1.09)	0.167	1.12(0.84-1.48)	0.436	1.17(1.06-1.29)	0.001	1.30(1.22-1.40)	<0.001
Husband/partner education level										
No education	Reference		Reference		Reference		Reference		Reference	
Primary	0.95(0.84-1.07)	0.371	1.01(0.94-1.07)	0.836	1.21(0.84-1.74)	0.306	0.86(0.79-0.93)	<0.001	0.89(0.82-0.98)	0.014
Secondary	0.79(0.67-0.92)	0.003	0.88(0.83-0.93)	<0.001	1.22(0.69-2.14)	0.491	0.77(0.69-0.84)	<0.001	0.73(0.67-0.79)	<0.001
Higher	0.56(0.42-0.75)	<0.001	0.75(0.65-0.86)	<0.001	NA	NA	0.63(0.49-0.82)	0.001	0.74(0.65-0.83)	<0.001
Highest Education Level										
No Education	Reference		Reference		Reference		Reference		Reference	
Primary	0.79(0.70-0.90)	<0.001	0.86(0.80-0.93)	<0.001	0.88(0.61-1.27)	0.506	0.75(0.67-0.85)	<0.001	0.97(0.87-1.09)	0.573
Secondary	0.64(0.55-0.76)	<0.001	0.67(0.62-0.72)	<0.001	0.42(0.22-0.81)	0.009	0.52(0.44-0.62)	<0.001	0.78(0.68-0.89)	<0.001
Higher	0.49(0.34-0.72)	<0.001	0.40(0.32-0.49)	<0.001	NA	NA	0.45(0.26-0.78)	0.004	0.38(0.29-0.49)	<0.001
Sex of child										
Male	Reference		Reference		Reference		Reference		Reference	

Female	0.94(0.85-1.03)	0.181	0.89(0.85-0.93)	<0.001	0.86(0.66-1.13)	0.297	0.84(0.78-0.89)	<0.001	0.94(0.89-1.01)	0.072
Wanted last child										
Wanted	Reference		Reference		Reference		Reference		Reference	
Wanted later	0.89(0.75-1.05)	0.167	0.76(0.69-0.83)	<0.001	1.19(0.71-2.01)	0.512	0.89(0.78-1.03)	0.121	0.68(0.60-0.78)	<0.001
Not wanted	0.79(0.70-0.90)	<0.001	0.93(0.89-0.98)	0.010	0.84(0.62-1.15)	0.287	0.81(0.75-0.87)	<0.001	0.85(0.78-0.93)	<0.001
Contraceptive use										
Using modern method	Reference		Reference		Reference		Reference		Reference	
Using traditional method	1.02(0.84-1.25)	0.814	1.24(1.14-1.36)	<0.001	0.65(0.35-1.23)	0.189	1.00(0.82-1.22)	0.984	1.01(0.88-1.16)	0.842
Non-user intends to use later	1.34(1.18-1.51)	<0.001	1.42(1.34-1.51)	<0.001	0.90(0.59-1.38)	0.629	1.35(1.24-1.46)	<0.001	1.13(1.03-1.24)	0.009
Does not intend to use	1.41(1.19-1.67)	<0.001	1.36(1.27-1.46)	<0.001	0.85(0.62-1.17)	0.345	1.49(1.34-1.65)	<0.001	1.28(1.17-1.39)	<0.001
Use tobacco										
Yes	Reference	NA	Reference		Reference		Reference		Reference	
No	N	NA	0.93 (0.88-0.98)	0.018	0.58(0.41-0.82)	0.002	0.79(0.74-0.86)	<0.001	0.80(0.71-0.90)	<0.001

5.5 Country differences in child survival patterns

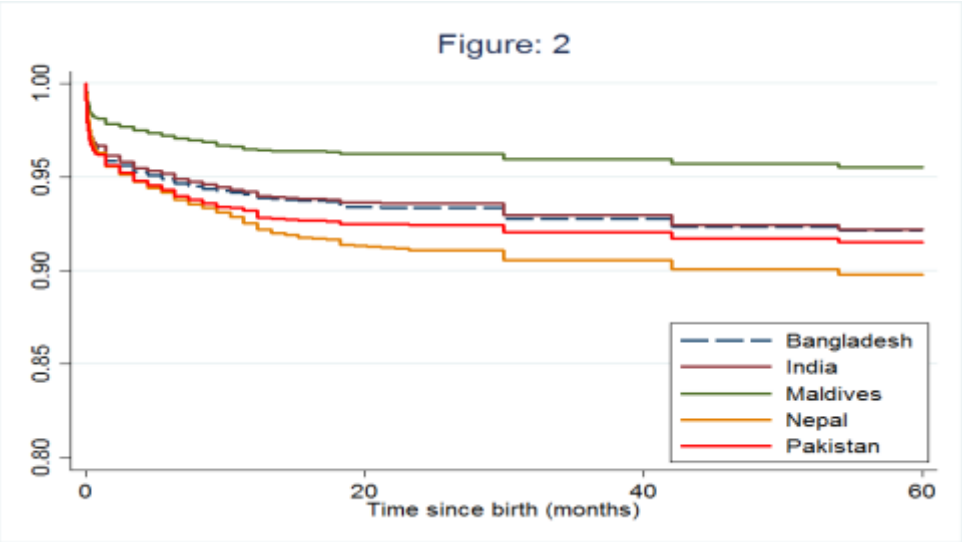

Figure 2: Survival curves of under-5 mortality in South Asian countries

Kaplan-Meier survival curves show the difference in survival patterns of survival of under-5 in children across South Asia. Maldives shows better survival of under-5 children, while Nepal shows poorest survival among the countries studied.

6. DISCUSSION

6.1 Summary of the main findings

The purpose of this study was to estimate the prevalence and risk factors associated with under-5 mortality in five South Asian countries (Bangladesh, India, Maldives, Nepal and Pakistan). Data was extracted from nationally representative Demographic and Health Survey (DHS) survey.

Findings from this study indicates the overall prevalence of under-5 mortality in South Asian countries from pooled data to be 10%. Risk factors such as age of mother, type of place of residence, wealth index, respondent currently working, education level of mother/husband, sex of child, wanted last child, contraceptive use, currently pregnant and tobacco use were significantly associated with under-5 mortality. Among all age groups, women with older age (45-49) were found to be at highest risk (13.5%) for under-5 mortality compared to the youngest age group (15-19). Women with rural place of residence had more under-5 mortality as compared to urban (10.9% vs 7.4%). Likewise, poor wealth index of mother (12.5%), employment (11.4%), no education (12.4%), no contraceptive use (13.3%), and smoking habit (13.9%) had higher prevalence of under-5 mortality. Male children had higher under-5 mortality as compared to female (10.2% vs 9.8%). The prevalence of under-5mortality in smoking mothers was the highest (13.9%).

Country-specific results showed that Nepal having the highest prevalence (11.1%) of under-5 mortality followed by India (10.3%) and Pakistan (10.2%) in South Asia. Bangladesh had highest prevalence of under-5 mortality for old age mothers (45-49) in contrast to the young age groups (HR:1.97 95% CI: 1.35-2.88). Among all countries, working women in Pakistan had highest prevalence for under-5 mortality (HR:1.30 95% CI: 1.22-1.40). Female children were found to be at significant increased risk of death in India and Nepal. Smoking mothers had highest Under-5 mortality in India (HR: 0.89 95%CI: 0.85-0.93) while the mothers who don't want to use contraceptives had highest risk of under-5 death in Nepal (HR: 1.49 95% CI: 1.34-1.65).

6.2 Prevalence of Under-5 mortality

The prevalence of under-5 mortality in South Asian countries was found to be 100 children per 1000 births in the pooled data (1999-2014). According to World bank, currently the prevalence of under-5 mortality in South Asia is 53 per 1000 live births in 2015. Country-specific results from our study shows highest prevalence of under-5 mortality in India (103 per 1000 live births) whereas the statistics from World bank shows Pakistan has the highest under-5 mortality rate with 81 deaths per 1000 live births in 2015 among WHO South Asian countries. (The world bank, 2017). These differences in the country specific and overall Under-5 mortality in South Asia can be because our study used the pooled data for analysis from 1990 to 2014. Moreover, the world bank collects overall population data while we used the DHS data collected from national and sub-national level of each studied countries in South Asia. However, comparing both the results show that under-5 mortality is still highly prevalent in all South Asian countries and need serious efforts to control.

6.3 Risk factors in Pooled data/common risk factors

In our study, we found that older women (45-49) had more likelihood under-5 mortality as compared to the women of young age. As the age decreases, risk of under-5 mortality also decreases. However, the youngest age group (15-19) was also found to be associated with increased risk of under-5 mortality compared to (20-24) years age group. Our study results are in line with the findings of many previous studies (Fall et al., 2015, Hanif, 2011, Paranjothy et.al., 2009, Ribeiro et al., 2014). In our study, prevalence of under-5 mortality was higher in rural areas. Similarly, a study from china indicates that neonatal health is poor in rural areas and requires special attention from the health authorities (Yi et al., 2011). Another study from Kenya demonstrates that the differences in childhood mortality between urban and rural population are decreasing with time. Between 1993 to 2008, decline was more rapid in rural areas as compared to urban (Kimani-Murage et al., 2014). The results from this study clearly wipes out the urban advantage for child health which is contrary to the results of our study. People in developing countries move from rural to urban areas for better life. Though even in urban areas, lots of people end up living in slums with poor health and living conditions which could be a possible reason for declining of differences of child mortality rate between rural and

urban areas. Our study also indicates that children from the mothers belonging to poor quantile of wealth index have high prevalence of under-5 mortality as compared to others. Socio-economic differences affect child mortality. Poor families have less care-seeking behavior for their children as compared to rich (Schellenberg et al., 2003). Children from the poor parents have more chances to get affected by pathogenic agents and less accessibility to life saving medicines which lead to higher mortality rates (Barros et al., 2010).

Results from our study indicate that working mothers have increased risk of under-5 mortality. Study from India shows that effect of mother's employment effect child health. However, it depends on different factors such as age of the child, type of employment and area of residence (Kishor et al., 1998). Another study shows that employment for mother can help to add second income to the family which helps to increase the wealth quantile and increase the standard of living (Heilman et al., 2008).

Findings from our study shows that parental especially mothers' education level have high impact on Under-5 mortality i.e. decreased risk of under-5 mortality among educated mothers. Similar results were found in a study on role of maternal education in child health from Zimbabwe. It indicates that increased level of mother's education helps to reduce the child mortality (Grepin et al., 2015). Similarly, another study from Turkey shows that maternal education helps to improve the child health by controlling factors such as smoking, decreased fertility and increased age at first birth (Gunes, 2015).

Our study estimates that male children have higher under-5 mortality as compared to their female counterparts. UN sex differentials in childhood mortality report shows that in many countries girls have advantage over boys in child mortality because of natural anatomy. However, in some other countries like China and India, girls are not benefited in the child mortality (UN, 2011). A study on gender differences in child health from many developing countries show that girls have more disadvantage over boys for childhood mortality (Choe, 2010). This could be due to wantedness of mother for male child in developing countries. Child of mother's desire faces better health and experience low illness during their childhood (Palloni, 2017).

In our study, the mother who didn't want to use contraceptives had increased risk of under-5 mortality. Study from Matlab, Bangladesh also shows that using contraceptive methods help to reduce the child mortality by increasing length of next birth interval (Saha et al., 2013). Another study shows that higher contraceptive used helped to reduce child mortality in Afghanistan (Rasooly et al., 2014). Intention of the pregnancy also affects the child health. A study from India shows that unwanted children have higher risk of adverse health outcomes and child mortality (Singh et al., 2013). Our study also indicates that there under-5 mortality for intended births are higher than unintended pregnancy in South Asian countries with a marginal difference. Risk for child mortality are higher if mother does not want the pregnancy. Unintended pregnancy is related with delayed prenatal care and decreased breastfeeding for child resulting in adverse health outcomes and mortality (Korenman et al., 2002).

Findings from our study also shows that smoking mothers have high under-5 mortality as compared to their counterparts. Several studies comply with out result showing that smoking causes increased risk for child health and mortality (Levy, 2013, Semba, 2008, Wisborg, 2001). Smoking mothers put their child at risk because smoking cause diversion of preferences for household income from food and basic necessities to smoking (Best et al., 2007)

6.4 Country specific risk factors

Findings from our study showed that proportion of risk factors causing under-5 mortality across different South Asian countries vary considerably. Old age mothers (45-49) had significantly highest risk of under-5 mortality in Bangladesh compared with Nepal, India, Maldives and Pakistan. Another study from Bangladesh also reported significant association of mother's age with under-5 mortality (Chowdhury, 2013). Results show that wealth quantile impact on under-5 mortality vary from one country to another but more concentrated in India showing that a significant highest risk of under-5 deaths for children belonging to poor wealth quantile. Study from India also relates to our finding showing that the relationship between household wealth and under-5 mortality is strong (Chalasani et al., 2014).

Likewise, association between education level of mother and under-5 mortality also vary across South Asian countries. We found that lowest level of education or no education of mother had

significantly highest risk for under-5 mortality in Nepal in contrast to other South Asian countries. A study from Nepal shows that there is a significant relationship between mother's level of education and breastfeeding practices (Acharya, 2015). Mother's education programs should be initiated at district level to give child better nutrition and health. According to WHO 60% of the child deaths worldwide are related to undernutrition (WHO, 2003).

The intention to use contraceptive methods or not also contributes majorly to the risk of under-5 mortality in all countries of South Asia with India having the highest risk of under-5 deaths for mother who does not intend to use contraceptive. National Family Health Survey of India also reports the decline in use of contraceptive methods all over India. In period of ten years, there was 6% decline in using of any modern contraceptive methods (National Family Health Survey, 2016). The results of this report are in line with our study showing that there is an urgent need for awareness program for use of modern contraceptive methods in India.

Each country showed significantly higher risks of under-5 mortality for smoking mothers with India at highest in contrast to other South Asian countries. The number of pregnant smoking and non-pregnant smoking women is equal in India which illustrates that women who use tobacco are not aware of their reproductive consequences (National Family Health Survey, 2006) Statistics from our study also shows that smoking is highly prevalent problem in pregnant mothers in India and should be avoided to improve the chances of child survival.

6.5 Strengths of Study

This study is based on Demographic and Health survey (DHS). Data is large and nationally representative of each country. DHS ensures the use of standardized questioners for the data collection reviewed by research committee comprising experts such as doctors, researchers, sociologists etc. Response rate to DHS survey is highest as compared to the other survey of national level. The use of standard questionnaire and data collection method from DHS makes the data comparable across different countries. This study reflects results from all the selected countries. Data is also used as reference for policy making at national level. Many international and national organizations also use this data for intervention and measuring national health outcome. This research topic is new in its context because this is the first pooled analysis from

1999-2014 using DHS data across WHO South Asian region. Pooled analysis helps to increase the strength of study and results can be generalized safely to the population covered of same characteristics.

6.6 Limitation of the Study

This study can't draw a causal relationship because it is based on retrospective cross-sectional data. Though interviewers in DHS data are properly trained to report all births/death information and produce accurate information yet mothers may not report all the births that happened long before survey or died at a very early age that may result in recall bias. There can also be chance of residual confounding because of unmeasured and hidden confounding factors.

Using a standard questionnaire comes with a disadvantage of limited chances to be locally relevant. Additions or deletions can be a part of questionnaire but only to a certain limit to maintain the comparability and avoid complications. Moreover, in the survey only surviving women were targeted for interview which may have caused the underestimation of under-5 mortality because of the association between mother's health and child mortality. Also in this study, several variables used were not child specific as they only describe the recent situation or childbirth such as employment status of mother which presented the working status of mother within the last 12 months past the survey.

6.7 Future Research

Although in our research we tried to cover different factors associated with Under-5 mortality in WHO South Asian region, yet wide range of factors could not be studied in this research. This study includes the factors associated with under-5 mortality at national level. Based on the results, further research can be done at sub-national level of each country which would be more helpful for policy makers to make precise strategies and interventions. Furthermore, study can be done for under-5 mortality to evaluate the issues from wider perspective. Further investigation on recent DHS data can help to make the results of this study more valid.

7. Conclusion and recommendation

This study focused on finding the prevalence and risk factors of Under-5 mortality in WHO South Asian countries (Bangladesh, India, Nepal, Pakistan and Maldives). Findings from our study show that levels of under-5 mortality remains high across all WHO South Asian countries with marginal differences. Risk factors such as old age of mother (45-49), no or low education level of mother/partner, no use of contraceptive, poor wealth quantile, and maternal smoking significantly influenced under-5 mortalities in each country and overall region.

Women ‘s education is cornerstone for improving the child survival. Higher level of mother or husband’s education was strongly associated with child survival in all countries. The practice of early marriages should be avoided to reduce adolescent pregnancy which could be helpful in increasing child survival. Women with more number of children or unwanted pregnancy pose a threat to the under-5 survivals. Therefore, the use of modern contraceptive methods should be encouraged. Easy access to contraceptives and information for using contraceptives should be easily available.

Improving the mother’s education level is long term strategy but short term national and community based educational intervention programs to counsel mothers and caretakers can be of paramount importance. Especially, mothers should also be educated about the good feeding practices and worst effects of smoking for their upcoming child.

Though these risk factors have been mentioned in earlier literatures, yet much improvement still needs to be done. Multi-faceted approach including health related measures is needed to improve the child survival. Any specific strategy for improving the child survival in any South Asian country should be based on risk factors that are specific to that country. For achieving the Sustainable Development target of reducing child mortality by 2030, countries in South Asian region needs to focus on child and mother health at top priority.

References

Abuya, B. A., Ciera, J., & Kimani-Murage, E. (2012). "Effect of mother's education on child's nutritional status in the slums of Nairobi". *BMC Paediatrics*, Vol. 12, P. 80.

Abir, T., Agho, K.E., Page, A.N., Milton, A.H., Dibley, M.J. (2015). Risk factors for under-5 mortality: evidence from Bangladesh Demographic and Health Survey. *BMJ*, vol 5, no. 8.

Acharya, P., Khanal, V. (2015). The effect of mother's educational status on early initiation of breastfeeding: further analysis of three consecutive Nepal Demographic and Health Surveys. *BMC Public Health*, vol.15.

African Leadership for Child Survival. (2012). *Africa Key Facts and Figures for Child Mortality.* Retrieved from USAID website: https://www.usaid.gov/sites/default/files/documents/1860/Africa Key Facts and Figures.pdf.

Adepoju, A.O., Akanni. O., Falusi, A.O. (2012). Determinants of child mortality in rural Nigeria. *Cancer Biology*, vol 2, no. 2, P.7.

Ayotunde, T., Marry, O., Melvin AO., Faniyi, FF. (2009). Maternal age at birth and under-5 mortality in Nigeria. *East African Journal of Public Health*, vol. 6(1), pp. 11-4.

Barros, F.C., Victora, C.G., Scherpbier, R., & Gwatkin, D. (2010). Socioeconomic inequities in the health and nutrition of children in low/middle income countries. *Revista De Saude Publica*, Vol 44, no. 1, PP 1-16. doi:S0034-89102010000100001 [pii]

Bale JR, Stoll BJ, Lucas, A O. (2003). Improving Birth outcomes: Meeting the challenge in developing world. *Institute of Medicine (US).*

Best, C. M., Sun, K., de Pee, S., Bloem, M. W., Stallkamp, G., & Semba, R. D. (2007). Parental tobacco use is associated with increased risk of child malnutrition in bangladesh. *Nutrition (Burbank, Los Angeles County, Calif.),* Vol. *23,* no. 10, pp. 731-738. doi:S0899-9007(07)00219-5 [pii]

Bloom, D.E., Williamson, J.G. (1998). Demographic transitions and economic miracles in emerging Asia *The World Bank Economic Review,* Vol. *12,* no. 3, pp. 419-455.

Boco, A.G. (2015). Assessing sex differentials in under-5 mortality in Sub-Saharan Africa: A cross-national comparative analysis. Canadian Studies in Population, Vol 41, PP. 49-87.

Caleyachtty, R., Tait, C.A., Kengne, A.P., Corvalan, C., Uauy, R., Echouffo-Techeugui, J.B. (2014). "Tobacco use in pregnant women: Analysis of data from demographic and health surveys from 54 low-income and middle-income countries". *The Lancet*, Vol.2, no. 9, pp. 513-620.

CDC. (n.d.). "Tobacco Use and Pregnancy". Retrieved from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/tobaccousepregnancy/

CDC. (n.d.). "Unintended Pregnancy Prevention". Retrieved from: https://www.cdc.gov/reproductivehealth/unintendedpregnancy/

CDC. (n.d.). "Global Diarrhea Burden". Retrieved from: https://www.cdc.gov/healthywater/global/diarrhea-burden.html#one

Chalasani, S., Rutstein, S. (2012). House health wealth and child health in India. *Population Studies,* Vol 68(1), PP. 15-41.

Choe, M.K. (2010). Sex differentials in Infant and Child Mortality in Korea. *Social Biology*, Vol 34, pp. 12-25.

Chowdhury, A. H. (2013). Determinants of Under-5 mortality in Bangladesh. *Open Journal of Statistics*, Vol. 3, pp. 213-219.

Chang, J.Y., Lee, K.S., Hahn, W.H., Chung, S.H., Choi, Y.S., Shim, K.S., Bae, C.W. (2011). Decreasing trends of Neonatal and Infant mortality rates in Korea: Compared with Japan, USA and OECD nations. *Journal of Korean Medical Science,* Vol. 26, no. 9, pp. 1115-1123.

Cheng, D., Schwarz, E. B., Douglas, E., & Horon, I. (2009). Unintended pregnancy and associated maternal preconception, prenatal and postpartum behaviors. *Contraception,* Vol. 79, no. 3, pp. 194-198.

Cha, S. (2017). The impact of the worldwide millennium development goals campaign on maternal and under-five child mortality reduction: 'where did the worldwide campaign work most effectively?'. *Global Health Action,* Vol. 10, no.1.

Cha, S., & Cho, Y. (2016). Changes in under-5 mortality rate and major childhood diseases: A country-level analysis. *Asia-Pacific Journal of Public Health,* Vol. *2*8, no. 2, pp. 178-196.

Cheng, D., Schwarz, E. B., Douglas E., & Horon, I. (2009). Unintended pregnancy and associated maternal preconception, prenatal and postpartum behaviors. *Contraception,* Vol. *7*9, no. 3, pp. 194-198.

Chola, L., McGee, S., Tugendhaft, A., Buchmann, E., Hofman, K. (2015). Scaling up family planning to reduce maternal and child mortality: The potential costs and benefits of modern contraceptive use in South Africa. *PloseOne*, Vol. 10, no. 6.

Cleland, J., Conde-Agudelo, A., Peterson, H., Ross, J., Tsui. A., (2012). "Contraception and Health". The Lancet, Vol 380, no. 9837, pp 149-156

DHSProgram. (2017). *Infant and Child Mortality*. Retrieved from: http://dhsprogram.com/topics/Infant-and-Child-Mortality.cfm

Doku, D & Neupane, S. (2017). Survival analysis of the association between antenatal care attendance and neonatal mortality in 57 low- and middle-income countries. *Int J Epidemiology*.

Dube, Z.B. (2012).“ The relationship between Mothers’ Maternal Age and Infant Mortality in Zimbabwe”. *University of Witwatersrand, Johannesburg*. Retrieved from: http://wiredspace.wits.ac.za/handle/10539/11568?show=full

ELSEVIER. (n.d.) *Health Policy*. Retrieved from http://www.journals.elsevier.com/health-policy

Ezeh, O.K., Agho, K.E., Dibley, M.J., Hall, J.J., Page, A.N. (2015) Risk factors for post neonatal, infant, child and under-5 mortality in Nigeria: a pooled cross-sectional analysis. *BMJ*, Vol.5.

Fall, C. H., Sachdev, H.S., Osmond, C., Restrepo-Mendez, M.C., Victora C., Martorell, R. (2015). Association between maternal age at childbirth and child and adult outcomes in the offspring: A prospective study in five low-income and middle-income countries (COHORTS collaboration). *The Lancet.Global Health,* Vol. *3*, no. 7, pp. 366-77. doi:10.1016/S2214-109X(15)00038-8 [doi]

Finlay, J.E., Ozaltin, E., Canning, D. (2011). Association of maternal age with infant mortality, child anthropometric failure, diarrhea and anemia for first births. *BMJ Open.*

Fleming, P., Blair, P.S. (2007). “Sudden Infant Death Syndrome and Parental Smoking”. *Science Direct*, Vol. 83, no. 11, pp. 721-725.

Gakidou, E., Cowling, K., Lozano, R., Murray, J.L. (2010). Increased educational attainment and its effect on child mortality in 175 countries between 1970 and 2009: a systematic analysis. *ScienceDirect*, Vol. 376, p. 959-974

GBD 2015 Mortality and Causes of Death Collaborators. (2016). Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: A systematic analysis for the global burden of disease study 2015. *Lancet (London, England)*, Vol, 388, no. 10053, pp. 1459-1544.

Grepin, K.A., Bharadwaj, P. (2015). Maternal Education and Child Mortality in Zimbabwe. *ELSEVIER*, Vol. 44, pp. 95-117

Guo, S., Rafique, N., You, D., Noble, D.J. (2016). Progress in South Asia after the launch of Global Every Newborn Action Plan. *Lancet*gh, Vol 4.

Günes, P.M. (2015). "The Role of Maternal Education in Child Health: Evidence from a Compulsory Schooling Law". *ELSEVIER*, Vol 47, pp 1-16.

Hanif, H.M. (2011). Association between maternal age and pregnancy outcome: Implications for the Pakistani society. *JPMA. The Journal of the Pakistan Medical Association*, Vol, 61, no. 3, pp. 313-319.

Health Epidemiology Reference Group. (2011). Neonatal mortality levels for 193 countries in 2009 with trends since 1990: A systematic analysis of progress, projections, and priorities. *PLOS Medicine*, Vol 8, no. 8, e. 1001080.

Heilman, M.E., & Okimoto, T. G. (2008). Motherhood: A potential source of bias in employment decisions. *The Journal of Applied Psychology*, Vol, *93*, no. 1, pp. 189-198.

Houweling TA., Kunst AE., Mackenbach JP. (2003). Measuring health inequality among children in developing countries: Does the choice of indicator of economic status matter? *International Journal for equity in Health*, Vol.2

Houweling, T.A.J., Kunst, A.E. (2010). Socio-economic inequalities in childhood mortality in low and middle-income countries: a review of the international evidence. *British Medical Bulletin*, Vol. 93, no. 1, pp. 7-26.

Huq, M.N., Tasnim, T. (2008). Maternal Education and Child healthcare in Bangladesh. *Maternal and Child Health Journal*, Vol 12, no. 1, pp 43-51.

Innvaer, S., Vist, G., Trommald, M., & Oxman, A. (2002). Health policy-makers' perceptions of their use of evidence: A systematic review. *Journal of Health Services Research & Policy*, Vol. 7, no. 4,pp. 239-244.

Johri, M., Subramanian, S.V., Sylvestre, M. P., Dudeja S., Chandra D., Kone G.K., et al. (2015). Association between maternal health literacy and child vaccination in India: A cross-sectional study. *Journal of Epidemiology and Community Health*, Vol. 69, no. 9, pp. 849-857.

Kenya National Bureau of Statistics. (2009). *Kenya demographic and health survey 2008-09*. Retrieved from: https://dhsprogram.com/pubs/pdf/fr229/fr229.pdf

Kishor, S., Parasuraman S. (1998). Mother's employment and infant and child mortality in India. *International Institute for population sciences*. Retrieved from: https://scholarspace.manoa.hawaii.edu/bitstream/10125/3474/1/NFHSsubjrpt008.pdf

Kimani-Murage, E. W., Fotso, J. C., Egondi, T., Abuya, B., Elungata, P., Ziraba, A. K., Madise, N. (2014). Trends in childhood mortality in Kenya: The urban advantage has seemingly been wiped out. *Health & Place*, Vol. *29*, pp. 95–103.

Korenman, S., Kaestner, R., & Joyce, T. (2002). Consequences for infants of parental disagreement in pregnancy intention. *Perspectives on Sexual and Reproductive Health*, Vol. 34, no. 4, pp. 198-205.

Kiros, G.E., Hogan, D.P. (2001). War, famine and excess child mortality in Africa: the role of parental education. *International Journal of Epidemiology*, Vol 30, no. 3, p. 447-455.

Lawn, J.E., Cousens, S., Zupan, J. (2005). 4 million neonatal deaths: When? Where and Why?. *The Lancet*, Vol 365, no. 9462, pp. 891-900

Liu, L., Oza, S., Hogan, D., Chu, Y., Perin, J., Zhu, J., Lawn, J.E., Cousens, S., Mathers, C., Black, R.E. (2016). Global, Regional and National Causes of under-5 mortality in 2000-15: an updated analysis with implications for Sustainable Development Goals. *The Lancet*, Vol, 388, no. 10063, pp. 3027-3035.

Levy, D., Jiang, M., Szklo, A., de Almeida, L. M., Autran, M., & Bloch, M. (2013). Smoking and Adverse Maternal and Child Health Outcomes in Brazil. *Nicotine & Tobacco Research*, Vol. *15*, no. 11,pp. 1797–1804.

Marston, C., & Cleland, J. (2003). Do unintended pregnancies carried to term lead to adverse outcomes for mother and child? an assessment in five developing countries. *Population Studies*, Vol, *57*, no 1, pp. 77-93.

Max Roser. (2017). *Child Mortality*. Retrieved from: https://ourworldindata.org/child-mortality/

Measure Evaluation. (n.d.). *Neonatal Mortality Rate.* Retrieved from https://www.measureevaluation.org/prh/rh_indicators/womens-health/nb/neonatal-mortality-rate-nmr

Ministry of Health and Family Welfare Government of India. (2016). *National Family Health Survey-4*. Retrieved from: http://rchiips.org/nfhs/pdf/NFHS4/India.pdf

MDGFUND. (2017). *Millennium Development Goals.* Retrieved from http://www.mdgfund.org/node/922

Ministry of Health and Family Welfare, Government of India. (2007). *National Family Health Survey-4*. Retrieved from: http://dhsprogram.com/pubs/pdf/FRIND3/FRIND3-Vol1andVol2.pdf

Mosely, W.H., Chen, L.C. (1984). An analytical framework for the study of child survival in developing countries. *JSTOR*, Vol. 10, pp.25-45.

Nair, M., Ariana, P., Webster, P. (2017). Impact of mothers' employment on infant feeding and care: a qualitative study of the experiences of mothers employed through the Mahatma Gandhi National Rural Employment Guarantee Act. *BMJ,* e004434.

OneWorld. (2016). *Nepal met MDG*. Retrieved from http://southasia.oneworld.net/news/nepal-mdg-4-target-met-but-long-way-to-go#.V1TIjCG2fIV

Oestergaard, M.Z., Inoue, M., Yoshida S., Mahanani, W.R., Gore, F.M., Cousens, S., Lawn, J.E., Mathers, C.D. (2011). Neonatal mortality levels for 193 countries in 2009 with trends since 1990: A systematic analysis of Progress, Projections and Priorities. *PLOS,* https://doi.org/10.1371/journal.pmed.1001080

Paranjothy, S., Broughton, H., Adappa, R., & Fone, D. (2009). Teenage pregnancy: Who suffers*? Archives of Disease in Childhood,* Vol. 94, no. 3, pp. 239-245. doi:10.1136/adc.2007.115915 [doi]

Palloni, G. (2017). Childhood health and wantedness of male and female children. Journal of Development Economic, Vol. 126, pp. 19-32.

Poduval, J., Poduval, M. (2009). Working mothers: How much working, How much mothers, and where is the Womanhood? MSM, Vol. 7, no. 1, pp. 63-79.

Poel, V.D., O'Donnell, Doorslaer, V. (2007). Are urban children really healthier? Evidence from 47 developing countries. *ELSEVIER*, Vol. 6, no. 10.

Rasooly, M. H., Govindasamy, P., Aqil, A., Rutstein, S., Arnold, F., Noormal, B., Shadoul, A. (2014). Success in reducing maternal and child mortality in Afghanistan. *Global Public Health,* Vol. *9,* no. 1, S 29-42.

Ribeiro, F. D., Ferrari, R. A., Sant'Anna, F. L., Dalmas, J. C., & Girotto, E. (2014). Extremes of maternal age and child mortality: Analysis between 2000 and 2009. [Extremos de idade materna e mortalidade infantil: analise entre 2000 e 2009] *Revista Paulista De Pediatria : Orgao Oficial Da Sociedade De Pediatria De Sao Paulo,* Vol. *3*2, no. 4, pp. 381-388.

Reynolds, HW., Wong, EL., Tucker, H. (2006). Adolescents'' use of maternal and child health services in developing countries. *International Family Planning Perspectives*, vol. 32, no. 1, pp. 6-16.

Reidpath, D., Allotey, P. (2003). Infant mortality rate as an indicator of population health. *Journal of Epidemiology and Community Health*, Vol. 57, no. 5, pp. 344-346.

Saha, U. R., & Van Soest, A. (2013). Contraceptive use, birth spacing, and child survival in matlab, Bangladesh. *Studies in Family Planning*, Vol. 44 no. 1, pp. 45-66.

Sastry, N. (1997). What explains rural-urban differentials in child mortality in brazil? *Social Science & Medicine (1982)*, Vol. 44, no. 7, pp. 989-1002.

Smith-Greenaway, E., Sennott, C. (2016). Death and desirability: Retrospective reporting of unintended pregnancy after a child's death. *Demography*, vol. 53, no. 3, pp. 805-834.

Stephenson, R., Matthews, Z., Mcdonald, J.W. (2003). "The Impact of Rural-Urban Migration on Under-Two Mortality in India". *Journal of Bio Social Science*, Vol. 35, no. 1, pp. 15-31.

Sunita, K., Sulabha, P. (1998). "Mother's employment and infant and child mortality in India". *International Institute of Population Science and Calverton*. Doi: http://hdl.handle.net/10125/3474

Semba, R.D., Pee, S.D., Sun, K., Best, C.M., Sari, M., Bloem, M.W. (2008). Paternal smoking and increased risk of infant and under-5 child mortality in Indonesia. *Am J Public Health*, Vol. 98, no. 10, pp. 1824-1826.

Smith, R., Ashford, L., Gribble, J., Clifton, D. (2009). "Family Planning Saves Lives". *Population Reference Bureau*. Retrieved from: http://www.prb.org/pdf09/familyplanningsaveslives.pdf

Sedgh, G., Singh, S., & Hussain, R. (2014). Intended and unintended pregnancies worldwide in 2012 and recent trends. *Studies in Family Planning*, Vol. 45, no. 3, pp. 301-314.

Sieminska, A., Jassem, E. (2014). The many faces of tobacco use among women. *Medical Science Monitor*, Vol. 20, pp. 153-162.

Kuntla, S., Goli, S., Jain, K. (2014). Explaining sex differentials in Child mortality in India: Trends and Determinants. *International Journal of Population Research*, vol. 2014, no. 2014.

Tamer, S.K., Mehta, P.K., Warey, P., Tamer, U., Swarnkar, J.S.. (1986). "A Study on Working Educated Mothers and its Impact on Child Health". *Indian Journal of Pediatrics*, 53: 657, doi: 10.1007/BF02748675.

Schellenberg, J. A., Victora, C.G., Mushi, A., de Savigny, D., Schellenberg, D., Mshinda, H. Tanzania Integrated Management of Childhood Illness MCE Baseline Household Survey Study Group. (2003). Inequities among the very poor: Health care for children in rural southern Tanzania. *Lancet (London, England)*, Vol. *36*1, no. 9357, pp. 561-566.

Singh, A., Mahapatra, B. (2013). The consequences of unintended pregnancy for maternal and child health in rural india: Evidence from prospective data. *Maternal and Child Health Journal*, Vo. *1*7, no. 3, pp. 493-500.

Smith-Greenway, E. (2013). Maternal reading skills and child mortality in Nigeria: A reassessment of why education matters. *Demography*, Vol 50, no. 5, pp. 1551-1561.

State. (n.d.). "Cause Specific Death Rate". Retrieved from: https://www26.state.nj.us/doh-shad/sharedstatic/CauseSpecificDeathRate.pdf

Teka, T., Faruque, A. S., & Fuchs, G. J., (1996). Risk factors for deaths in under-age-five children attending a diarrhea treatment center. *Acta Paediatrica (Oslo, Norway : 1992), 85*(9), 1070-1075.

UNICEF. (2016). *Child Mortality-Neonatal*. Retrieved from http://data.unicef.org/child-mortality/neonatal.html

UNICEF. (2016). *Child Mortality- Under-5*. Retrieved from http://data.unicef.org/child-mortality/under-five.html

UN. (2016). *MDG Report*. Retrieved from: http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20%28July%201%29.pdf

UNDP. (2016) *MDG 4*. Retrieved from http://www.bd.undp.org/content/bangladesh/en/home/post-2015/millennium-development-goals/mdg4.html

UN. (2016). *Sustainable Development*. Retrieved from http://www.un.org/sustainabledevelopment/health/

UN. (2015). *Transforming Our World. The 2030 Agenda for Sustainable Development*, Retrieved from: https://www.un.org/pga/wp-content/uploads/sites/3/2015/08/120815_outcome-document-of-Summit-for-adoption-of-the-post-2015-development-agenda.pdf

UN. (2014). *World Urbanization Prospects.* Retrieved from https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf

UN. (2011). *Sex differentials in Childhood Mortality*. *Department of Economic and Social Affairs*. Retrieved from: http://www.un.org/esa/population/publications/SexDifChildMort/SexDifferentialsChildhoodMortality.pdf

UNICEF. (n.d). *Basic Indicator*. Retrieved from https://www.unicef.org/infobycountry/stats_popup1.html

UN Interagency Group. (2015). *Levels and Trends in Child Mortality*. Retrieved from: http://www.who.int/maternal_child_adolescent/documents/levels_trends_child_mortality_2015/en/

UN. (2013). *Adolescent Fertility since the International Conference on Population and Development (ICPD) in Cairo*, Retrieved from: http://www.un.org/en/development/desa/population/publications/pdf/fertility/Report_Adolescent-Fertility-since-ICPD.pdf

UN. (2012). *World Urbanization Prospects- The 2011 revision,* Retrieved from: http://www.un.org/en/development/desa/population/publications/pdf/urbanization/WUP2011_Report.pdf

UN. (2000). *The World Health Report - Health systems: Improving performance,* Retrieved from: http://www.who.int/whr/2000/en/whr00_en.pdf?ua=1

UN. (2014). *World urbanization prospects: The 2014 revision*. Retrieved from https://www.compassion.com/multimedia/world-urbanization-prospects.pdf

UN. (2017). *United nations millennium development goals.* Retrieved from http://www.un.org/millenniumgoals/childhealth.shtml

UN. (2011). *Sex Differentials in Childhood Mortality*. Retrieved from http://www.un.org/esa/population/publications/SexDifChildMort/SexDifferentialsChildhoodMortality.pdf

UN. (n.d.). *Under-five Mortality*, Retrieved from: http://www.who.int/gho/child_health/mortality/mortality_under_five_text/en/

UN. (2015). *Resolution adopted by General Assembly on 25th September, 2015*. Retrieved from: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

UNICEF. (2017). *Committing to Child Survival: A promise Renewed*. Retrieved from http://www.apromiserenewed.org/wp-content/uploads/2015/09/APR_2015_8_Sep_15.pdf

UNICEF. (2015). *Child Mortality Report.* Retrieved from https://www.unicef.org/publications/files/Child_Mortality_Report_2015_Web_9_Sept_15.pdf

Victora, C.G., Wagstaff, A., Schellenberg, J. A., Gwatkin, D., Claeson, M., & Habicht, J. (2003). Applying an equity lens to child health and mortality: More of the same is not enough. *The Lancet*, Vol. *362*, no. 9379, pp. 233-241.

Wado, Y. D., Afework, M. F., & Hindin, M. J., (2013). Unintended pregnancies and the use of maternal health services in southwestern Ethiopia. *BMC International Health and Human Rights*.

Wagstaff, A. (2000). Socioeconomic inequalities in child mortality: Comparisons across nine developing countries. *Bulletin of the World Health Organization,* vol. *7*8, no. 1, pp. 19-29.

Wang H., Murray J.L., et al. (2016). Global, Regional and National Life Expectancy, all- cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet, Vol.388, no. 10053, pp. 1459-1544.

WHO. (2016). *Child Mortality Report*. Retrieved from http://www.who.int/mediacentre/news/releases/2015/child-mortality-report/en/

WHO. (2015). *Infant Mortality*. Retrieved from http://www.who.int/gho/child_health/mortality/neonatal_infant_text/en/

WHO. (2015). *Neonatal Mortality.* Retrieved from http://www.who.int/gho/child_health/mortality/neonatal_text/en/

WHO. (n.d.). *Global Health Observatory Data.* Retrieved from: http://www.who.int/gho/en/

WHO. (2016). *Family Planning/Contraception*. Retrieved from http://www.who.int/mediacentre/factsheets/fs351/en/

WHO. (2017). *Tobacco*. Retrieved from http://www.who.int/mediacentre/factsheets/fs339/en/

WHO. (2012). *Family Planning: A Health and Development Issue, a key Intervention for Survival of Women and Children*. Retrieved from http://apps.who.int/iris/bitstream/10665/75165/1/WHO_RHR_HRP_12.23_eng.pdf

WHO. (2015). *Tanzania Country Study*. Retrieved from http://www.who.int/life-course/news/tanzania-country-study-15june2015.pdf?ua=1

WHO. (2014). *Adolescent Pregnancy*, Retrieved from: http://www.who.int/mediacentre/factsheets/fs364/en/

WHO. (2011). "Child Mortality". Retrieved from: http://www.who.int/pmnch/media/press_materials/fs/fs_mdg4_childmortality/en/

WHO. (n.d.). *Child mortality indicators: Latest situation and change over time* Retrieved from http://www.who.int/gho/health_equity/outcomes/under5_mortality_text/en/

WHO. (2016). *Family Planning/Contraception*. Retrieved from http://www.who.int/mediacentre/factsheets/fs351/en/

WHO, (n.d.), *Infant mortality*, Retrieved from http://www.who.int/gho/child_health/mortality/neonatal_infant_text/en/

WHO. (2017). "*Tobacco*". Retrieved from http://www.who.int/mediacentre/factsheets/fs339/en/

WHO. (2015). *Under-five Mortality* Retrieved from: http://www.who.int/gho/child_health/mortality/mortality_under_five_text/en/

WHO. (2012). "*Family Planning: A Health and Development Issue, a key Intervention for Survival of Women and Children*". Retrieved from http://apps.who.int/iris/bitstream/10665/75165/1/WHO_RHR_HRP_12.23_eng.pdf

WHO. (2016). *Under-5 Mortality*. Retrieved from http://www.who.int/gho/child_health/mortality/mortality_under_five_text/en/

WHO. (2003). Global Strategy for Infant and Young Child feeding. Retrieved from: http://apps.who.int/iris/bitstream/10665/42590/1/9241562218.pdf?ua=1&ua=1

Wisborg, K., Kesmodel, U., Henriksen, T.B., Olsen, S.F., Secher, N.J. (2001). A prospective study of smoking during pregnancy and SIDS. *BMJ*, Vol. 83, P. 203.

Whyte, S. R., & Kariuki, P. W. (1991). Malnutrition and gender relations in western Kenya. *Health Transition Review: The Cultural, Social, and Behavioral Determinants of Health*, vol. 1, no. 2, pp. 171-187.

World Bank. (2017). *Mortality Rate- Under-5*. Retrieved from http://data.worldbank.org/indicator/SH.DYN.MORT

Wang, Y., Liddell, C. A., Coates, M.M., Mooney, M. D., Levitz, C. E., Schumacher, A. E. et al. (2014). Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990-2013: A systematic analysis for the global burden of disease study 2013. *Lancet (London, England)*, Vol. *38*4, no. 9947, pp. 957-979.

Wang, Y., Li, X., Zhou, M., Luo, S. et al. (2016). Under-5 mortality in 2851 Chinese counties, 1996–2012: a subnational assessment of achieving MDG 4 goals in China. *Lancet*, Vol. 387, pp. 273-283.

Yi, B., Wu, L., Liu, H., Fang, W., Hu, Y., & Wang, Y. (2011). Rural-urban differences of neonatal mortality in a poorly developed province of china *BMC Public Health, 1*1, 477-2458-11-477. doi:10.1186/1471-2458-11-477 [doe]

You, D., Hug, L., Eldemire, S., Ideal, P., Hogan, D., Mathers, C., et al. (2015). Global, regional, and national levels and trends in under-5 mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN inter-agency group for child mortality estimation. *Lancet,* Vol. 386, no. 10010, pp. 2275-2286.